

With the Author's Compliments

2

ON

REGRESSIVE PARALYSIS,

(INFANTILE PARALYSIS. SPINAL
PARALYSIS OF ADULTS).

BY

WILLIAM H. BARLOW, M.D.,

CONSULTING PHYSICIAN TO THE DISPENSARY, GENERAL HOSPITAL AND
DISPENSARY FOR SICK CHILDREN, MANCHESTER.

MANCHESTER:
J. E. CORNISH, 12, PICCADILLY.
1878.

Since the foregoing pages have been printed, Dr. T. Althaus has published a work "On Infantile Paralysis and some allied diseases of the Spinal Cord : their diagnosis and treatment, 1878," in which some of the remarks and conclusions to which I had arrived, would seem to have been anticipated, making it necessary for me to state that the MS. of the preceding paper, has been in the Printer's hands for the last twelve months.

Sept., 1878.

W. H. B.

ON
REGRESSIVE PARALYSIS,
(INFANTILE PARALYSIS. SPINAL
PARALYSIS OF ADULTS),

BY
WILLIAM H. BARLOW, M.D.,

CONSULTING PHYSICIAN TO THE DISPENSARY, GENERAL HOSPITAL AND
DISPENSARY FOR SICK CHILDREN, MANCHESTER.

MANCHESTER:
J. E. CORNISH, 12, PICCADILLY.
1878.

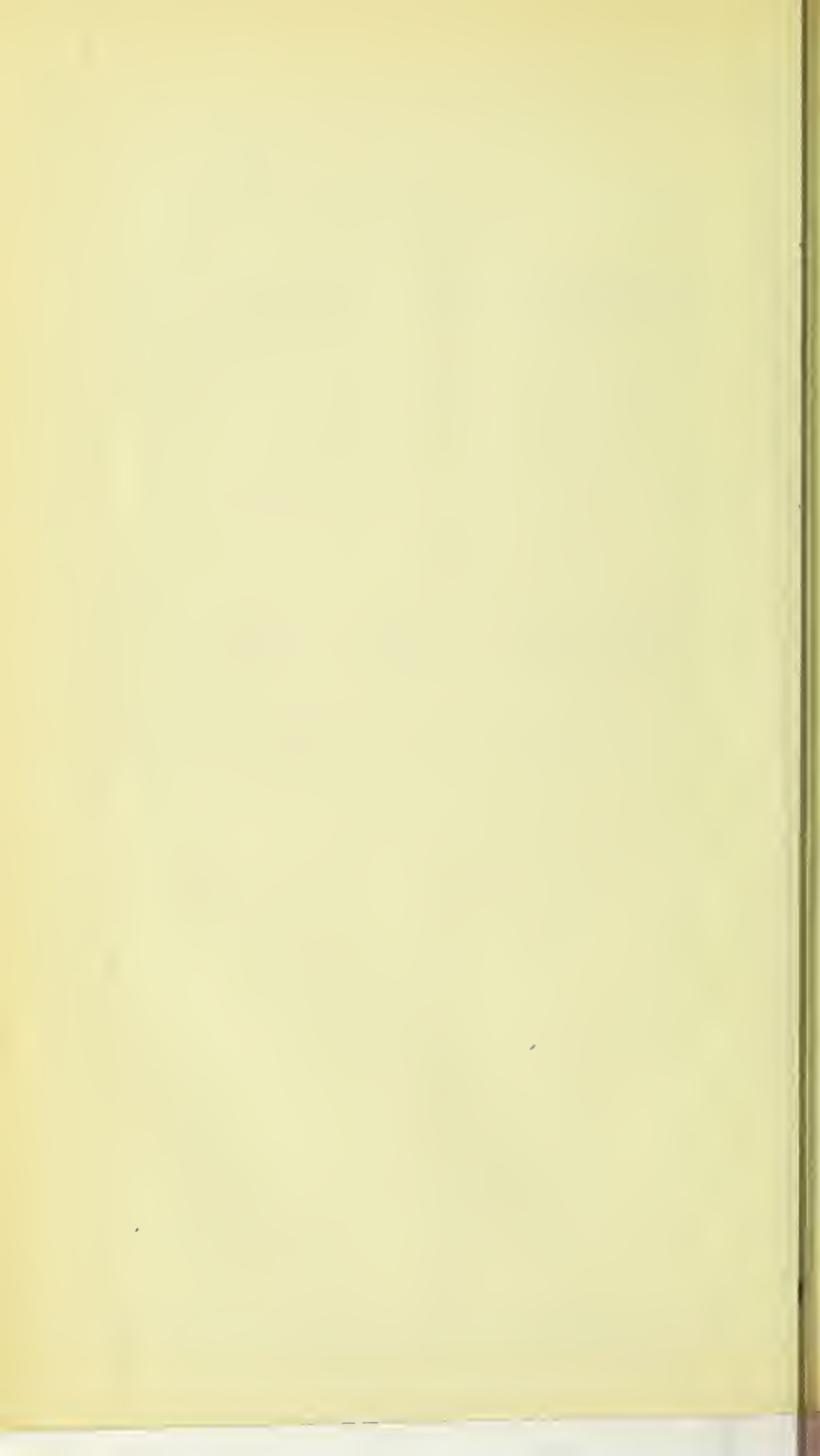




Fig. 6

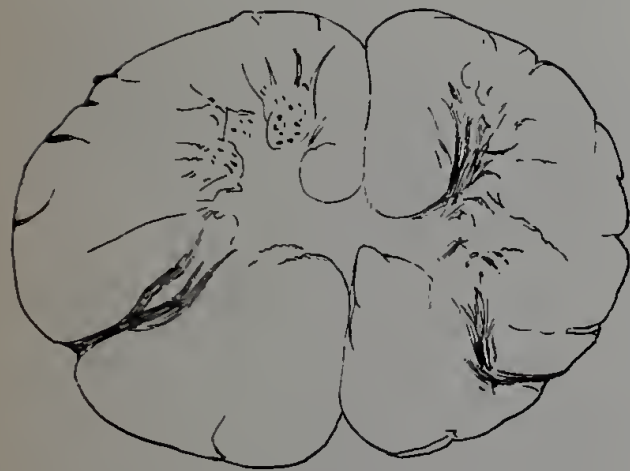
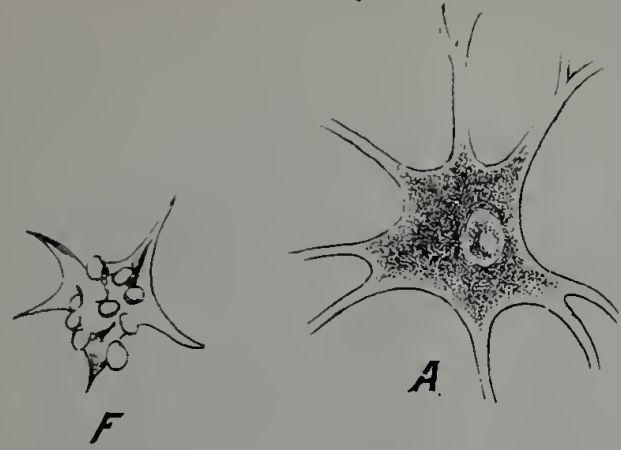


Fig. 4

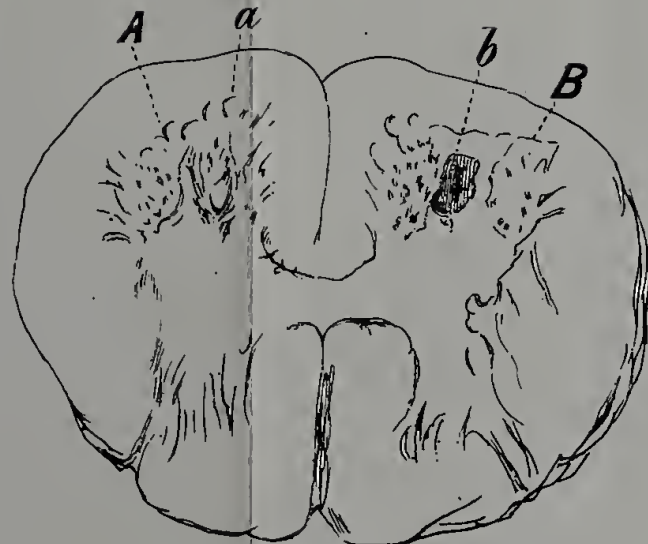


Fig. 5



D



B

Fig. 6



C



Fig. 7



Fig. 1



Fig. 2

SKETCHED FROM A CAST. CASE 38



Fig. 3

FROM A CAST OF LEG. CASE 51

DESCRIPTION OF PLATES.

Figs. 1, (Case 26) 2, and 3, Description attached.

Fig. 4, (After Charcot).

Section of Spinal Cord, from the Cervical Region of a case of Infantile (Regressive) Paralysis of the Right Upper Extremity, from a female dying at the age of 50 years—Atrophy of the Anterior Cornu of the right side, consecutive wasting of all the white fibres of the corresponding side of the Cord.

Fig. 5, (After Charcot).

Section of Cord Lumbar Region.

(A) Anterior Cornu (sound).

(a) Ganglionic Nucleus (sound).

(B) Anterior Cornu right.

(b) Median Ganglionic Nucleus in which the Motor cells are destroyed, and which is represented by a patch of Sclerosis.

Fig. 6, Nerve Cells of Anterior Cornu of Spinal Cord; (A) Normal State; (B) Hypertrophied; (C) Pigmentary alteration; (D) Pigmentary alteration at its last stage; (E) Cell affected by Sclerotic Atrophy; (F) Alteration Vacuolaire.

Fig. 7, Muscular Fibre undergoing Degeneration (last stage).

(See also fig. in Paper on Pseudo Hypertrophic Paralysis, in LIVERPOOL AND MANCHESTER MEDICAL AND SURGICAL REPORT for 1876).

ERRATA.

By an unfortunate misunderstanding, the first sixteen pages of this paper were printed before the proofs had undergone complete revision, the reader is, therefore, requested to make the following corrections :—

- Page 2 line 2 read Charcot for Chorcot
,, 2 ,, 2 ,, Salpêtrière for Salpêtriere.
,, 2 ,, 6 ,, myogenique for myogenigue.
,, 2 ,, 19 ,, rigor for rigour.
,, 3 ,, 3 of note read diphtheritic for diphthisitic.
,, 4 ,, 15 ,, read Enunciated for Communciated.
,, 9 ,, 10 after the word case, Nos. 3, 51, &c.
,, 9 ,, 29 read occurred for occured.
,, 10 ,, 9 ,, symptom for system.
,, 11 ,, 23 ,, anterior, posterior for antero-posterior.
,, 11 ,, 25 ,, reversing for revolving.
,, 13 ,, 1 ,, trophic for tropic.
,, 13 ,, 13 ,, Duchenne de, for Dacherme del.
,, 13 ,, 21 ,, definitive for defective.
,, 16 ,, 5 ,, growth for grouth.

ON REGRESSIVE PARALYSIS,

(INFANTILE PARALYSIS. SPINAL PARALYSIS OF ADULTS)

BY

WILLIAM H. BARLOW, M.D.,

HON. MEDICAL OFFICER GENERAL HOSPITAL AND DISPENSARY FOR SICK CHILDREN,

MANCHESTER.

The disease of which I propose to treat under the above name, has hitherto, been described under two separate heads, according as it has affected subjects of an early age or those in more mature life. Much more frequently found in the former class, it has been generally known as Infantile Paralysis, receiving many additional and distinguishing prefixes, according to the opinions or theories of the various writers, thus Heine very correctly named it "Spinale Kinderlähmung," (1) Rilliet, (2) less happily, "Essential Paralysis," Duchenne, (3) "Paralysie atrophique graisseuse de l'enfance," and more lately, amending that description by the light of later knowledge, he has omitted the adjective "graisseuse," calling it merely "Paralysie atrophique de l'enfance." Being comparatively rare in adult life its identity has not been

acknowledged until quite recently, when the pathological researches of Chorcot and his pupils of the Salpêtrière, proved the identity of the morbid lesion, which the similarity of symptoms and causation had already made to appear probable. It has been described as rheumatic paralysis, and as acute spinal paralysis of adults, (Seguin, &c.,) as myogenigue, by Bouchut, and as idiopathic paralysis.

Whether in infants or adults, this affection possesses certain clearly marked peculiarities, which distinguish it from all other affections of a paralytic character; these are *firstly*—as regards the primary exciting cause of the attack, *secondly*—as regards the mode of onset, *thirdly*—as regards the extent and character of the paralysis, *fourthly*—as regards the regression of the paralysis, *fifthly*—as regards the subsequent progress of the case, with its results of atrophy and deformity of the members affected.

The progress of a typical case is somewhat as follows, a young child, or it may be an adult, after some exposure to external influences; severe cold, or prolonged exposure to wet, is seized with a rigour, followed by feverish symptoms, and in some cases convulsions, or troubles of the cerebral functions, and this, after enduring a variable length of time, passes away leaving the patient paralyzed, it may be in one limb or two, or all four. Most frequently the two lower limbs are affected, and the paralysis assumes a paraplegic character, but not unfrequently one leg and one arm will be so affected, generally the arm and leg of opposite sides of the body, but *sometimes* taking a true hemiplegic form. Sometimes an upper extremity alone is affected, and sometimes the neck, face, and even the trunk, and the tongue participate.

Whatever be the extent of the paralysis, it is always found to possess certain characteristics, the limbs hang flaccid, there is no trace of muscular spasm or rigidity, the skin retains its sensibility, but all reflex power is lost.

At first, the muscles respond to the induced or faradaic current, but in a short time, they lose this power, though they still and for a longer period, retain their power of response to the continuous, or

rather the galvanic current of electricity. There is no marked affection of the sphincters, or of the functions of the bladder or rectum ; at the most, and then later on in the case, there may be a slight degree of irritability of the bladder.

There are rarely any cerebral complications, when these do exist they may be looked upon as accidental.

After a time, varying in length, within considerable limits, some members recover their power, or some muscles, or groups of muscles, in one or more limbs, are left paralyzed, while the others recover ; this is a symptom so constant and so peculiar as to mark off this form of paralysis, sharply and strongly from all others, and it is on this account that I have chosen the designation which I have placed at the head of this paper.

We have many forms of *progressive* paralysis, but no other true regressive form, the name spinal paralysis is vague and unsatisfactory, as there are many other forms, which may equally claim that designation, and the limitation to infancy or adult life is now known to be incorrect ; I have, therefore, ventured to propose and adopt a distinguishing name, which marks the chief and peculiar symptom of this disease, a symptom which is never absent in this and which is present in no other, so far as our knowledge extends, as a constant and pathognomonic characteristic.* *See note.* After this regression has taken place, the muscles still left paralyzed, speedily waste and atrophy.

The skin over the limb, becomes bluish or mottled, and the

*I am not here considering that tendency to recovery, which is common to all reflex paralysis, and to many of those due to blood poisons, such as the diphtheritic paralysis, nor to the partial recoveries which frequently occur in cerebral paralysis. I do not look upon these latter as at all distinctive of the nature of the morbid affection to which the paralysis is due, but as extraneous or accidental ; and the former class of cases recover, because the affection has been essentially functional ; but the essential character of this form of paralysis is, that together with a functional, there exists also an organic change, affecting, it may be, single and isolated, or, it may be, an aggregation of motor cells of the anterior cornua. In this particular, the paralysis of which we treat is peculiar, and though I do not forget that the essential lesion is much the same in progressive muscular atrophy, yet, as has been well said by Dr. Dreschfeld, of this city, the latter would appear to be the chronic form, of a morbid process, of which the one at present under discussion may be considered the acute form.

temperature falls considerably; trophic troubles become marked, the skin becomes liable to boils, the nutrition of all the structures are affected, the bones dwindle, and certain deformities to be more fully dwelt upon hereafter, are entailed upon the affected limb. Such is a brief history of a case of this nature, whether it occur in the infant or the adult, and just as the symptoms and course of the malady are identical at the two periods of life so are the pathological changes. In making this statement, I am aware that I am going somewhat further than the great authority upon these affections, Duchenne, has ventured, but he seems to have met with cases, complicated with other lesions, and other classes of symptomatology, and suffered these to cloud the clearness of outline which other of his cases present. I shall return to this subject again in its proper place and there more fully explain my reasons for holding the opinions communciated above, meantime, let us proceed to study the disease more in detail; and as the cases occuring in infancy are more numerous, more free from complications, and have been more completely worked out, than those occuring in adult life, let us first study these, and afterwards proceed to show the identity of the disease in the two periods.

OF THE REGRESSIVE PARALYSIS IN INFANCY.

My remarks are founded upon very numerous observations made during the last seven years, in the patients coming under my observation at the General Hospital for Sick Children, in this city, and in my own private practice. Of these I have tabulated 63 cases, and it is from this store that I select my examples and collect my facts and generalizations.

I have not found the influence of sex to be at all marked in this form of paralysis, of 63 cases, 33 were males and 30 females. The age most liable to attack is from the first to the second year, 42 cases out of a total of 63 occuring between those ages. Of the influence of season we have strong evidence; of 53 cases, in which the date of attack could be fixed with accuracy, 27 occurred in the months of July and August, a fact worthy of notice as having a

bearing upon the primary causation of this affection. No one can fail to note that it is precisely at the age at which the nervous system is most excitable, and when from the processes of development, and the evolution of the teeth, the whole system is most readily affected by outer influences, when diarrhœa, convulsions, and other reflex troubles are most common, that this affection most frequently appears; nor can we avoid the conclusion that the reason why the two months of July and August, shew a preponderance of attacks of this nature, is the same as that, which causes them to be prominent with regard to diarrhœa and other reflex troubles. That, in short, it is to the peculiar climatic conditions of those months which pre-dispose to chills and sudden variations of temperature, that much if not all of this preponderance is due. In short, I am of opinion, that this paralysis is of a reflex nature, and in that view I am supported by Brown-Sequard, (1) West, (2) and many other writers, though opposed by Duchenne and most of the French school. An examination of the circumstance, immediately preceding these cases, has shown that of a total of 63, there has been clear evidence of exposure to cold, or to vicissitudes of temperatures in 16; the attack has been immediately preceded by diarrhœa, in seven cases; by scarlatina, measles, and modified smallpox, each once; by troubles of dentition, five times; and once (though I admit it with some doubt) I have found a history of fright. In eleven cases the attack was preceded by convulsions, by fever without convulsions, or other perceptible exciting cause, 17 times; while in 10 cases nothing whatever had been noticed precedent to the seizure. Laborde (3) doubted the presence of convulsions but they have been well established by the testimony of almost every observer since he wrote. Kennedy (4) believed that vicious decubitus and pressure upon the nerves might give rise to the palsy, but it has been well shewn these paralyses, and the painful contractions and so-called "Rheumatic Paralyses" of Chassaignac, are of a nature entirely distinct.

It was a confusion, between these and true cases of regressive paralysis, that led Duchenne and Heine, and many other writers,

to deny, that what they called the temporary paralysis of Kennedy, were to be placed in the same category as those severe cases which were followed by atrophy and deformity of the limbs. But it is now well established that cases of this nature do occur, and the only distinction between these and the graver cases, is in the fact that in the one the regression is complete, in the other partial; of this nature is the following case—

Annie M. Briggs, aged eleven months, a strong healthy child, one of a large family, the issue of healthy parents. On the evening of May 9th, 1875, (a bright sunny day) she was put to bed apparently quite well. She was cross and fretful during the night, and when taken up next morning the right leg was found to be paralyzed, the muscles affected being the anterior and external group, the leg hung flaccid and useless; electro-muscular contractility to the induced current, was reduced, but not lost; the sensibility was unaffected. This case was under my care from the first, and the paralysis gradually disappeared, lingering longest in the extensor communis digitorum and anterior muscles of the leg. In three weeks it had entirely disappeared, and the child now walks without the slightest trace of ever having suffered from this affection. Now in what respect does this case differ from those that proceed to atrophy and trophic changes? Save, that the primary exciting cause would seem to be not of sufficient strength to permanently affect the nerve centres, producing, as it were, a temporary congestion, not persisting sufficiently long to destroy the life of the nerve cell; producing in short over the whole area affected, only that degree of alteration, which in the graver cases, existed in the outer parts of such area.

The age most liable to attack is as I have said, that between the first and second year; it is exceedingly rare after the fifth year. My own experience has not brought to my knowledge one case after the age of five, except one which occurred at the age of 18; thus, it would seem, that there is a period which seems to be, if not exempt, at least very seldom affected by the causes which lead to this form of paralysis.

I find in my table of cases that there occurred

under the age of 6 months, 6 attacks					
from 6 months to	12	„	18	„	
„ 12 „ „	18	„	12	„	
„ 1½ year „	2 years	11	„		
„ 2 years „	5	„	12	„	
Age at attack unknown	4	„			

Total 63.

In a considerable number of cases I have found a history of some antecedent exposure to heat or cold, in many so marked and so immediately followed by the paralytic symptoms as to render it impossible to doubt that the connections between cause and effect must exist between them. The following case is one of many. (16 out of a total of 53 in which the history of the attack could be traced.)

(Case 12) Ann Smith, aged at the time of the attack, one year and nine months, had convulsions when three months old, bronchitis at seven months, and measles at sixteen months, which latter was followed by a purulent discharge from the right ear, which had ceased some time. The child was apparently in full health when her father was seized with typhoid fever; he was attended in his own cottage and nursed with great devotion by his wife until his death. On that day, amid the agitation and disturbance of the family, the child was overlooked, and strayed away from the open door of the cottage and was lost. It was in the month of July, and the day was thundery, wet, and towards evening cold, and for a considerable time the child must have been exposed to the weather. Late in the evening she was found by the police, and taken to the office, where she was found by her mother sitting in her wet clothes before a fire. She was taken home and put to bed, apparently quite well, but tired, the mother thinks she slept well, (probably worn out with excitement and watching the mother herself would sleep soundly), but in the morning she was found with her right arm and leg quite paralyzed, and her mouth drawn to the right side. She could previously

speaking well for her age but now she had quite lost the power of speech. The arm gradually recovered its power of movement, the facial distortion disappeared, the speech became once more intelligible, and when two years and a month old, the right leg was the only part still paralyzed; this, however, underwent the characteristic atrophy, and assumed the usual position of deformity, the limb shorter than the one of the opposite side, and the foot assuming characters of the "Pes Cavus."

The temperature of the limb was lowered, the skin bluish mottled and stocking marked, and the sensibility unaffected.

There can be no doubt whatever of the real nature of this case, though from its extent it assumed some of the features most frequent in cerebral paralysis, but the regression and the progress of the case to final atrophy and deformity clearly mark out its character, nor can I doubt that the primary cause of the central changes was the exposure to the wet and cold, which so immediately preceded the attack. In another case equally well marked in its progress, by regression, by atrophy, and deformity, the child had after a long journey, on a hot sultry day, to a seaside watering place, been sent out with a nurse, in a perambulator, which had been standing in the rain outside a shop door, from which it was hired.

(Case 17) W. H. B., a strong well formed boy, was quite well until five months old, when the family went to Lytham. In the first week of October, 1872, the weather was sultry, but cold towards evening. That evening it rained; a perambulator which had been standing at a shop door was hired, and the nurse took him out, next morning he was found fretful and feverish, and had passed a bad night, a thing very unusual for him. This feverish state continued for a few days. When I next saw him his mother called my attention to his curious position as he sat upon her knee, and I found him to be totally paralysed in the right side and the neck, the head falling upon the shoulder. This state of things gradually improved, the paralysis finally affecting only the anterior and external group of the right leg, but these were struck with atrophy, and the limb, though by long and careful persevering

electrisation and exercise, it was saved from extreme deformity, still carries the results of the attack in the form of slight shortening, diminution in circumference, lowering of temperature, and atrophy of the extensor communis digitorum muscle.

In several cases, this child has been sitting upon cold stone floors or door steps, a cause mentioned by Kennedy, but not generally allowed by later observers, except by West and Hammond, (2) but I have found myself compelled to believe that this may be an exciting cause, and that the reason why this and similar exposures, such as (case) taking the child in the heat of the sun without head covering, removal to a new house with damp plaster on the walls, &c., &c., have not been recognised as primary causes by so accurate an observer as Duchenne, and by other writers who have followed him, is that the cases were not seen sufficiently early, and the recollection of the circumstances preceding the event has been lost by the parent or nurse.

I have had the good fortune to see many of these cases at a very early stage, the two I have mentioned, from the very onset, and they have been under my observation ever since. It is but seldom, that the competent observer has such opportunities of seeing these cases in the earliest periods, and it is probably due to this want that cases of the lighter form, where the regression is complete, are comparatively rare in the published records. It is to be noticed that in a large proportion of these cases there are at onset some cerebral complications. Convulsions preceded the attack in eleven cases, and it is not unlikely that in several of those, in which no antecedent symptoms were observed, where the child after being put to bed apparently well the previous night, was found in the morning to be paralysed, these may have occurred during the night and thus passed unobserved. (see cases)

The occurrence of true hemiplegia in this kind of paralysis is a fact which was strongly denied by Heine, (1) and formerly also by Duchenne, but it has since been established by several observers, and among others by Duchenne fils. (2) I found it to have occurred in five cases, but as explaining the rarity which led Heine to

assert that it never did occur in this particular affection, but belonged altogether to a distinct category ; I may remark that of those five cases in which the arm and leg of the same side were affected, together with in some cases, the side of the face, the neck, and the tongue, that it only persisted in both arm and leg in two of these. In the rest it receded, leaving the leg only permanently affected. Seeing cases only in an advanced stage, Heine must have missed such, as the three I have recorded, (cases 5, 10, 11, 12, 17,) and thus have been led to look upon this system as belonging to the true cerebral form of paralysis only.

The affection of the tongue, face, and neck, and the analogy of the antecedents to those causing the true cerebral paralysis, lead me to conclude that the supposition of a congestion or inflammatory exudation receding from above downwards, is probably correct, and also points the caution not to put too distinct a line between this and the cerebral forms, as in its higher degrees it may approach very nearly or probably even be found in combination with these.

The children affected are often, if not generally, otherwise healthy, intelligent, and active, presenting in their appearance a marked contrast to those afflicted with paralysis of a cerebral origin. (see fig. 1) Indeed the contrast between the active intelligent mind and the crippled limbs is one of the saddest and most affecting aspects of this disease.

As this case is a fairly typical one and well illustrates the statement I have just made, I will recount it.

Alexander Male, (case 26) was a strong healthy child, who never had any sickness of any kind until four months old, when, in the month of August, 1868, the father being a station master, was removed from Manchester to Sheffield. The weather was hot and sultry and the mother was greatly fatigued, in consequence of which the child was a good deal exposed. A day or two afterwards he was feverish and relaxed in his bowels, which condition continued for three days before medical assistance was obtained ; during this time he was restless and moaned in the night, he was then attended by a medical man for about a fortnight, but had no convulsions nor

any contractions either of fingers or toes. It was not until the surgeon had ceased to attend, that he was removed from his bed ; neither the surgeon in attendance nor the mother herself having noticed anything wrong, and it was not until two or three days later, that the mother noticed that he did not kick about as he had been accustomed to do before his illness, but lay quite still. This induced her to examine him more closely, and she found that he could not use his legs, and they hung quite flaccid and loosely from the hips. She did not at this time notice any affection of the arm, though she has since noticed that one arm is smaller than the other. He was taken to the medical man who had attended him previously and the electro-magnetic current was applied to the *spine* (not to the limbs) frictions were applied, and soon a slight and very gradual improvement was observed. *He was then left handed*, but has since, so says the mother, "been broken of the habit".

When brought under my notice he was a bright intelligent boy of six years old, whose appearance at once arouses all our sympathy. He is quite a cripple from the hips downwards. The extensor muscles of the leg upon the thigh, and the abductors of the thigh are quite paralyzed on both sides, the knees are partly flexed and turned outwards and he progresses by the action of the abductors of the thigh, which throw the limb outwards. The muscles of the antero-posterior, and external groups of the left leg, are paralyzed and to 14 cells of Stöhrers continuous current battery give only feeble tremulations, and that only by quickly revolving the poles. Sensation is undiminished, the current from a single cell being felt and dreaded by the boy. The right leg is paralyzed as to the anterior and external groups of muscles only, there is consequently varus on this side, when the foot is thrown forward in attempting to walk. The bones of the thigh and leg are visible in all their contour, scarcely clothed with more than a drapery of skin and the remnants of the rectus femoris ; which muscle, and the extensor proprius pollicis seem almost the only muscles left ; and when made to contract these stand out like cords under the skin.

On the left side even this small amount of muscular activity does

not exist. The temperature of both limbs is considerably lowered and the skin has the bluish mottled appearance characteristic of these cases, and the feet and legs are stocking marked. In this case it is evident (although from defective observation or from forgetfulness, from the lapse of time (six years), the fact does not appear very clearly in the evidence) that the right arm participated in the paralysis at the outset, and it yet bears marks of the attack being smaller than the left, and measuring somewhat less round the deltoid at the level of the lower edge of the fold of the armpit. Indeed, I have never found nor have I read of any case, in which this symptom (the regression) had made default, and it is on that account that I think it merits the distinction of characterising this paralysis. This important and characteristic symptom takes place usually about three weeks after the onset of the febrile symptoms, but it may not be completed for some months, or even for one or two years (Laborde, page 34). It varies exceedingly in extent, and usually takes place from above downwards, and from the parts nearest to the nervous centres outwards. Though Laborde (page 36) mentions one case where he saw the trunk still affected on the tenth day, while the superior extremities were completely released. The mode in which the regression takes place is also peculiar and characteristic, it is not sudden, or complete, but gradual, receding from this or that group of muscles as it were by choice or selection. It is rare that the paralysis remains in all the muscles of a limb, even in the worst cases it is found to have retired from some of those primarily affected, and it frequently leaves all except a certain group or groups. In the lower limb it is the anterior and external group of muscles that are most frequently left paralyzed. These peculiarities have received their explanation from recent pathological researches which have shewn that it is the affection of the large motor cells of the cord, which determines the definitive paralysis and its consequent results; and thus adds to the previous observation, that the groups of muscles affected, were under a common nerve supply, the explanation alike of the grouping, and of the distinction, of those spared, and those doomed to undergo

the structural and tropic change. (1)

In my own experience I found one case (No. 32) in which at the onset all four limbs were affected, but eventually, regression took place from the two upper and one lower extremity, leaving only the left leg to definitive paralysis and atrophy; in another (case 36) where all four limbs were affected at the outset, the two upper extremities recovered, but the lower were left still paralyzed. Two cases in which both legs and one arm (right) resulted in definitive paralysis of the right leg only. My own experience goes to shew that the crossed form of paralysis, is generally the result of regression from one or more limbs, in cases where three or all four have been affected at the onset. I have not seen myself any case in which the two upper extremities alone have been affected, but Dacherme del Boulogne fils, records such. (2)

Cases have been recorded (Laborde page 36 and seq) where after complete recovery from one attack, there has been a second, and even a third, followed at last by persistent paralysis. I have not myself seen any such cases. I have found one upper extremity to be affected alone in six cases, while one or both legs were affected alone in 42. Heine divided these various forms of this paralysis as regards its defective seat into three classes. 1st, where it involves both lower limbs infantile spinal paraplegia. 2nd, where one leg only was affected or one leg and one arm of the opposite sides "hemiplegia spinalis;" he denied the existence of the true hemiplegic form, (but further observation has now proved its existence,) and third partial paralysis limited to single sets of muscles of a limb. The muscles of the trunk or back when affected are very rarely the seat of persistent paralysis in this affection. Where the upper extremity is the seat of definitive paralysis, it is the muscles of the shoulder, the deltoid, and teres muscles and the scapular group, which are generally affected, the paralysis retiring in this case from below upwards.

In the thigh it is the group of anterior and internal muscles the adductors of the thigh, and the quadriceps extensor of the leg that chiefly suffer, while in the leg, the anterior and external group,

the extensor communis digitorum, the tibialis anticus and the peronei are most frequently affected, when the gastrocnemius is affected, the anterior muscles are usually spared. The proper muscles of the foot seldom participate. The extensor communis digitorum and the peronei are by far the most frequently, the subjects of definitive paralysis and perhaps next in order is the tibialis anticus. The regression is, as we have said, gradual, proceeding, as it were, by analysis leaving first the central parts, the trunk and the neck, it next retires from some of the limbs, and then from certain groups of muscles even in those limbs which are eventually to suffer atrophy and deformity. Leaving first one group and then another, until only those doomed to definitive palsy are left subject to its influence. It was this peculiarity which seems to have misled Brünniche (1) who argues that if the paralysis had a peripheral origin it would attack all the muscles supplied by the same nerve, and mentions that the external popliteal branch of the sciatic nerve, being distributed to the extensor communis digitorum, the extensor proprius pollicis, the tibialis anticus, and the extensor brevis digitorum ("pedieux") and the long and short peronei, and therefore if a peripheral impression affected it, it would affect all the muscles to which it is supplied, but one or more of these muscles, notably, the short extensor of the toes, is habitually spared. The recent proofs that the true central lesion is in the great motor cells, single or combined will, however, explain this fact in a manner perfectly consonant with the results of observation. Of this however, we shall treat more fully at a later stage.

The sensibility does not suffer any marked change in this paralysis, at least, in the established condition. At the onset there is some amount of fever, with increase of temperature and probably some amount of hyper æsthesia, but it is rarely that cases come under the notice of the profession at so early a date, and still more rarely, that the nature of the case is recognised at so early a stage. After the stage of fever and hyperhæmia have passed away, the sensibility is found to be somewhat blunted, as though the nervous influence had become partially exhausted, but it speedily recovers,

and remains then unaffected by the further progress of the case. The reflex action in response to light irritations, such as tickling, pinching, and the milder degrees of heat or cold, is in general speedily lost, though the power of muscular contraction, upon the stimulus of electricity remains in the muscles affected for a longer time. So early however as the third day from the onset it has been found to be enfeebled (Duchenne 1) and very soon after this date it is entirely lost, to the stimulation of the induced current. Even then however, it is still retained to the continuous current, and the power of answering by contractions to this latter current, persists a longer period, a fact which has a high clinical importance, for so long as a muscle responds to the galvanic current, so long we may hope for its eventual recovery, a recovery which is always preceded by its loss of power to answer to the continuous, but a recovery of power to respond to the stimulus of the induced current.

Affections of the special senses are very rare in this form of paralysis, but as we have seen the tongue may be affected and so interfere with the speech, but this is generally as in the case mentioned, (Ann Smith) but temporary, the functions of the bladder or rectum, are rarely affected, there is in some cases a little irritability of the bladder, and sometimes also of the rectum, most marked during electrical conditions of the atmosphere, and leading to involuntary micturition or even defecation, but even in these cases the sphincters as a rule, are quite competent to fulfil their functions under ordinary conditions.

The trophic changes however speedily become very marked, the temperature of the skin decreases, and this decrease may be recognised by the mere touch of the hand. The reduction amounts in old established cases, according to Heine, (1) who gave a number of tables, to 4° or 5° Reaumur or 10 to $12\frac{1}{2}^{\circ}$ F below the normal. This symptom is in very marked contrast to the conditions which hold, in the cerebral paralysis of infancy. There are also marked changes in the circulatory system of the limb, the skin becomes slack and the "turgor vitalis" is remarkably diminished,

and the limb assumes a mottled or bluish colour, and becomes liable to chilblains and furuncular eruptions; it is easily injured and is slow in healing, in short, it exhibits all the marks of some great injury sustained by the apparatus upon which depends its nutrition and growth.

In like manner is the muscular system affected; and with it the bones and all other structures of the limb, all testify to some great nervous injury involving the nutritive apparatus.

The paralysed limbs hang flaccid and dangle loosely like a flail they can be moved freely in all directions, yet are entirely beyond the control of the will. The boy, Male, (case 26) shews this very well when he walks he casts his legs, as it were from him, by the action of the abductors of the thigh, and they traverse a segment of a circle without any other muscular aid, and come to the ground, the toes first, as the most dependent part.

These superficial and early signs are speedily followed by the changes consequent upon the alterations of function which they denote, The muscles definitively paralysed now speedily atrophy undergoing changes both in bulk, and very frequently also in structure, the circumference of the limbs dwindles in proportion as they waste, till in severe and advanced cases the bones appear covered with little more than skin. (see fig. 1) The same arrest in development is found as time progresses to extend to the bones, vessels and nerves; the bones do not grow either in length or circumference, the vessels are smaller than on the sound limb. The paralysed leg may be found after some years to be from two to six inches shorter than the sound limb, and the patella has been found to be one-third less than its fellow. "The thin atrophied vessels may be recognised by the small thready pulse, and the atrophy of the peripheral nerves has been shewn by post-mortem examination." (1) The shortening of the bones of the lower extremities may vary from the slightest perceptible amount to three or four inches, or probably even more. In the upper extremity the shortening is not so marked from the dependent position of the arm. The paralysis and atrophy of the muscles, is speedily followed by

certain deformities; some of which are the immediate results of paralysis, and others are developed by the unequal growth of the paralyzed muscles, and those which are left without permanent injury. In the lower extremity there ensue those vicious positions of the foot, which are known as talipes, various forms of club-foot. Indeed, it may be said that the great majority of cases of club-foot, which arise after birth, are due to paralytic affections of the muscles, and of these also, the majority are due to this special form of paralysis. The most frequent deformity in the leg, is a form of talipes varus, produced by the paralysis of the muscles which abduct, and elevate the outer border of the foot; the muscles most frequently affected, being the peronei, and the extensor of the toes, and tibialis anticus; from this results, a depression of the point of the foot, and of the outer border, but in the first instance, there is no raising of the heel, it is the point of the foot that falls. This condition is well explained by Volkmann, (1) who quotes Hüter as having shewn "that the mass of the foot is so unequally distributed "around the axis of motion of the joints, that when left to assume "any position by its own weight, the foot not only drops at the "toes, or as it is commonly said, stretches out, (plantar flexion) but at the same time makes a second movement, by which the internal edge of the foot, comes to stand higher than the outer, (supination) and the great toe passes inwards (adduction). And "thus this position which the foot takes of itself, when left quite "free from the action of the muscles, is exactly that, which we "observe as a rule in paralytic deformities, though in a higher degree."

Volkmann denies the existence of tonus in the muscles and says: (p. 129) 1st—"Even in complete paralysis of the entire muscles "of the lower leg, we may have the severest forms of club-foot, "and in complete paralysis of the muscles of the forearm, the "most intense contraction of the hand and fingers." (It should be borne in mind that he does not here speak of a true contraction,

(1) Volkmann, Prof. R., Clinical Lecture delivered at Halle, New Sydenham Soc'y, Vol. for 1876.

such as that which exists in some cerebral forms of paralysis, but another form which might almost be termed a passive contraction, and which will be further mentioned hereafter.)

"2nd—In imperfect but very extensive paralysis, it not unfrequently happens, that in the arm as well as the foot, it is the muscles, which lie in the concavity (therefore the shortened ones) which are specially paralyzed, while according to the antagonistic theory it should be the opposite."

"3rd—But even in paralysis of one group of muscles exclusively the deviation may occur on the paralyzed side."

He also quotes Dieffenbach to the effect that "all children, at birth, have a club-foot in the first degree," and notes that, the earlier the attack, and the longer the child is in learning to walk, the more easily does the foot fix itself in the position of Equino-Varus, while if it is older and could already walk when the paralytic seizure took place, it soon begins to walk again and a paralytic flat foot occurs.

He further remarks, that "no proper contraction ever takes place at the knee, even when the paralysis extends to the thigh; that on the contrary the joint becomes too moveable, and this always in the same way; it is over extended. The thigh and leg come to form an obtuse angle open anteriorly, (*genu recurvatum*) and he then proceeds to explain how this occurs, pointing out that the weight of the limb always tends towards extension, both in the upright and recumbent position, and thus "the flexors of the knee are often enough stretched, even in perfect paralysis of their antagonists, to prevent them, as it were, rusting in their position of contraction." It is thus that he explains, the formation of the *genu recurvatum* in these cases, remarking that in walking, the paralyzed leg is used as an artificial leg would be; (a fact which will at once strike the observer, who watches the progression of a patient, so paralyzed in both leg and thigh,) and shews how the artificial leg is swung from the hip, and the knee is made moveable by a hinge which allows flexion, but not extension beyond 180° , where a check is fixed, so that the weight of the body presses against this as a fixed point. But he proceeds to shew that in

practice, this check is placed by the instrument maker, slightly behind the limit of 180° , thus forming a kind of artificial genu recurvatum, and giving to the artificial limb, a greater degree of stability; and he argues that the paralytic genu recurvatum arises in much the same way, the ligaments round the joint forming the check, and yielding a little, so that in this way the limb may be used as a rigid support. The figure (plate, fig. 1) gives a good idea of the deformities of the foot and leg in these cases. In addition to these, occur later, as a consequence of the shortening, (or rather of the growth of the sound limb) a form of pes Equinus, and more rarely this is combined with a Valgus. Laborde (1) speaks also of a raising of the toes and depression of the heel, forming a talipes calcaneus, from paralysis of the posterior muscles of the leg, this is a form which I have not seen, nor should I think it very likely to occur in this form of paralysis, were it not also mentioned by so accurate an observer as Heine. There is one peculiar deformity of the foot peculiar to this paralysis, and, I believe, pathognomonic, it is the pes cavus; "talis pied creux" of the French, it consists in a hollowing of the sole, and prominence of the instep, and is combined with varus and equinism, (see plate, fig. 3) Duchenne believes it to arise, from a paralysis more or less complete, of the triceps sural, and the simultaneous retraction of the extensors of the toes, one form of this, called by Bouvier, (2) "talis pied creux direct," is produced by the action the peronei and the extensors of the toes. But this explanation does not agree with Volkmann's idea of the formation of these deformities. The same writer states (3) that he has seen children in which in consequence of the small degree of alteration in the muscles of the feet and the small extent of essential deformity, scarcely limp, and keep on their legs a good part of the day, yet in whom there has been considerable shortening, and in

(1) Laborde—De la Paralytie (dite essentielle) de l'enfance, Paris, 1864.

(2) Bouvier—Dict de méd et chirurg. prat. Paris, 1835, tom 13, p. 73, art Pied Bot.

(3) Volkmann—Ueber Kinderlähmung und paralytische contracturen; Sammlung Klinischer Vorträge. No. 1, Leipzig, 1870, p. 6.

this I can corroborate him from my own experience. He also says that he has seen a temporary paralysis followed by recovery of motor power, and yet also by trophic lesions of the bones persisting all the life.

Where the upper extremity is affected the deformity is not so marked in the earlier stages, the weight of the limb in its dependent position preserves until the last stages, (when the bones, become in length as well as in the diameter, relatively smaller than the sound side), the normal appearance of the limb; but it is at the shoulder where the great differences are seen. The mass of the deltoid diminished, until the bones are sharply defined under the skin, and the round head of the humerus and the edge of the glenoid cavity are clearly to be traced. At the same time the teres and supra and infra spinati muscles, wither also, and there is a peculiar flatness of the scapular mass, due to the atrophy of muscular masses of the spinati muscles. The muscles of the forearm, are seldom involved. I have never seen them in cases of this category. It is in the class of cerebral paralysis that we find the forearm and fingers involved and distorted, and the deformities in that case arise from contraction of muscles, and owe their origin to morbid processes, seated in distinct portions of the nervous centres, forming a class apart and which I shall proceed to consider at a future time. In the case which now concerns us, there is no contraction of muscles properly so called; the members hang flaccid and loose, and the child will move them with the sound hand, like so many pieces of machinery, and the position and helplessness of the limb as it dangles, was very well likened by Heine to a flail.

The shortening of the sound muscles has been ascribed by most writers to "tonus," a proposition which Volkmann denies, and he says, that the limbs fall into their peculiar positions, by their own dead weight, the sound muscles merely ceasing to grow in consequence of the loss of stimulus, from the action of their paralyzed opponents. These considerations come to bear a practical value, when we consider the treatment of the deformities due to this cause, and in the proper place will come again under observation.

In an extreme degree of atrophy, the deformities imposed upon the hands and arms are as follows:—The hands are rotated outwards, with the palm upwards, the fingers lightly flexed, the elbow in forced extension, and the forearm like the hand has undergone a rotation from within outwards, its anterior and internal face becomes external and superior, (Laborde, p. 78) this, however, is very exceptional, usually the deformities in the upper extremity are confined to the shoulder, and adjacent parts, and the scapular and clavicular muscles. The triceps brachial is sometimes involved in these cases.

The deformities of the neck and trunk are generally temporary, though a few are mentioned in which they have persisted in the trunk, from paralysis of the sacro-spinal muscles. Duchenne relates cases of this nature. (1) When this happens, there ensues a cyphosis by reason of the preponderating action of the flexors of the spine, and therefore to establish the equilibrium and prevent the dragging forward of the body, the patient constantly and by a conscious effort carries the trunk backwards, and thus ensues a lordosis, which is peculiar in this; that the buttocks instead of becoming prominent as in other forms of lordosis, are rendered less so, the pelvis being dragged forward instead of backward. In both cases, however, this kind of lordosis is at once relieved and effaced by the horizontal position, or even by sitting.

Relying upon the results of his earlier examinations, Duchenne proposed for this paralysis the name of "Paralysie atrophique graisseuse de l'enfance," because he believed that the atrophied muscles underwent a fatty change; but further and wider experience has shewn that this is not a necessary consequence of the paralysis, though it is a frequent one. Duchenne has acknowledged this in his later writings (2) and it may now be taken for granted that the change may be either a fatty degeneration, a granular change, or a simple atrophy, with or without fatty substitution. Hammond (3) mentions two cases, in which after the lapse of four years, he "found

(1) Duchenne—*L'électrisation localisée*, 3rd Edn, p. 393, et seq.

(2) " " " " p. 382.

(3) Hammond—*Diseases of the Nervous System*, New York, p. 691.

the structure of the muscle unchanged. There were atrophy, loss of electro contractility, and reduction of temperature, but every specimen of the affected muscles that I examined showed no changes from the normal characters."

It may be now accepted as proven, that the muscular tissue may present an appearance perfectly normal, although it has undergone a marked degree of atrophy. The only change in these cases being a diminution in volume. On the other hand the fibres may exhibit a marked degree of fatty change.

The principal changes may be expressed in the following degrees marked by Laborde (1) 1st—"In the first degree one can perceive still evident traces of the striation of muscular bundles, (*faisceaux*) but that striation is singularly diminished, it is as though spaced. The wide spaces in which it no longer exists are filled with molecular and opaque granulations, a great number of which also cover the striated bundles which remain; these granulations completely survive treatment with alcohol or ether, their number diminishes sensibly under the influence of acetic acid when a little prolonged. This state which seems to be one of the first phases of the morbid action, shews itself in the muscles least altered in appearance, and which have preserved some bundles still reddish, visible to the naked eye."

2nd—A degree more advanced in which there is scarcely any appreciable trace of striation, only the longitudinal fibres almost "deprived of undulation, appear in the primitive and secondary *faisceaux*, the granular substance being everywhere very abundant."

3rd—In the third degree the striation has completely disappeared the bundles of longitudinal fibres which only persist, are themselves very rare; in all cases they are as if smothered under the mass of granulations of the same nature as those we have mentioned, the outer fascicular spaces are filled with close fibres of cellular tissue with scattered nuclei." (2)

4th—The fourth part of the morbid process represents no more,

(1) Laborde—Loc cit, p. 130.

(2)—See plate, fig. 7, and also figures illustrating paper on Pseudo Hypertrophic Paralysis in last vol. of Reports.

so to speak, than the skeleton of the muscular bundles, which nevertheless still contains traces of the longitudinal fibres; it is the granular condition which predominates, and these granulations themselves, compose alone, the contents of the said bundles. The latter moreover have become very scarce, the spaces left between them are much larger than in the normal state, and the fibres of the cellular tissue are in consequence⁷ relatively more abundant.

5th—Finally, at the last degree of alteration, not only has all trace of the muscular tissue, properly so called, disappeared, but even the granular substance itself scarcely exists, as if its rôle was accomplished; only the transparent hyaline tubes of the myolemma persist, with some rare granulations along their walls, they are moreover very spaced, and surrounded by fibres, like a brush or pencil of cellular and fibrous tissue, with which are mixed some elements of elastic tissue.”

These two last conditions, express the state of the muscles, which have totally lost their normal aspect, and appear only as grayish cords of fibrous appearance. The question will at once arise, is there a creation of new fibrous tissue? The muscle seems to be reduced to its embryonic condition. Has it then the powers of development which belong to that condition? Laborde (1) answers the question in the negative. Speaking of the case upon which these observations were made, he says “Dans un seul point, très limité, appartenant à la portion, la plus atrophiée du deltoïde gauche, nous avons rencontré des noyaux embryoplastiques témoignant d’un travail néoplasmatique,” but the most minute researches have not found any similar fact, and it ought to have existed, if it were constant, in all the atrophied muscles.

In this same case, the sound opponents of the paralyzed muscles, were found to be invaded by adipose vesicles, between the bundles of muscular tissue; they were in fact interstitial, and the primitive fibre of the muscle s unaltered, and preserves its normal characteristics unimpaired. The practical conclusion is that the muscular atrophy may be simple, without fatty degeneration, and may be

(1) Laborde—Loc cit,

expressed only by a discoloration and diminution in volume, of the muscular fibres, or it may proceed gradually, to a complete destruction of the properties of the muscles, unaccompanied by any change other than a purely granular condition. Nevertheless in many cases, (probably in a majority,) the muscles do undergo fatty change, and the changes which then ensue, are briefly, the presence of oil globules, the disappearance of the transverse striæ next the disappearance of the fibrillæ and the conversion of the muscle into a mass of oil globules, and fat vesicles; finally an absorption of the fatty elements, and there remains in the place of the muscle, nothing more, than a mass of connective tissue, in which no trace of muscular tissue, and neither longitudinal nor transverse striæ can be discovered.

As to the periods at which these changes occur, it may be asserted as a general rule, that so soon as the electro-muscular contractility, of the affected muscle is definitely lost, so soon do the structural changes commence, though they may proceed with varying degrees of rapidity in different cases. M. Duchenne (1) has demonstrated the change in muscular structure three weeks after the muscle has been struck with paralysis. Volkmann believes that the granulo-fatty change is comparatively rare in the first instance, and that there is a development of nuclei; in brief, that the irritative processes predominate at this stage, over those which may be called passive and which do not occur until later on.

OF THE REGRESSIVE PARALYSIS IN THE ADULT.

It will be well at this point of our subject, to leave for a moment, the regular course of description, with the consideration of the nervous lesions and the general points of diagnosis and prognosis; to consider and compare, the disease as seen in adult life, with that, the general characters of which we have already studied so far as observation during life will allow; afterwards to consider the pathological lesions, common to both forms, which can only be

(1) Duchenne—Loc cit, p. 398.

studied after death, and finally to proceed to the study of the diagnosis and treatment of the two forms, of what we must regard as essentially the same disease. Gombault (archives de Physiologie normale et Pathologique, 1873, p. 80 to 87) describes a case of this kind, a female, aged at the time of the attack, 62 years, who suddenly, one day was seized with a feeling of numbness, which was followed by palsy in all the limbs, the sensibility was normal, the respiration, the deglutition, and all the cerebral functions unimpaired. She had no bed sores nor any palsy of the bladder or sphincter ani. She had at the commencement, and for months afterwards, considerable pain in the back. Fifteen days later she was taken to hospital, and was there found to have preserved the sensibility of the surface unimpaired, but as to motor power she was completely paralyzed. There were no contractions of the palsied limbs. After two years she began to improve, the upper limbs recovering first, and in three and a-half years she was able to walk a little with the aid of a stick. In 1872, five years after the onset of the disease, he proved the existence of slight wasting of the arms and forearms, considerable atrophy of the hand muscles, the thenar eminences and the inter-ossei, the hand assumed the form known as the "main en griffe," and the extensors were very weak. The muscles of the arms and forearms shewed fibrillary contractions. There was considerable atrophy of many muscles of the legs, and loss of electro muscular reaction in the hands and extensor group of the forearm, lessened reaction in the whole of the hand and forearm, diminished reaction in the muscles of the lower limbs, no numbness, anaesthesia or pain. Death took place on July 19th, 1872. The atrophied muscles were found to be in various stages of granulo fatty degeneration. No lesion was visible to the naked eye in either the brain or spinal cord, but when hardened by chromic acid and examined in sections prepared by the mode adopted by Lockhart Clarke, lesions were found in the ganglion cells of the anterior horns, the white columns and posterior gray horns being formed normal in all their length.

Of the nature of these lesions we shall speak hereafter, the

object now in view being to give a view of the characteristic features of the affection as seen from without.

Duchenne (1) relates a case (one among several.) It is of a young lady, 22 years of age, of good health, who woke one morning with fever, and universal shivering, and difficulty of movement, without known cause. About one hour afterwards, there were pains extremely vivid in the course of the vertebral columns, especially at the level of the cervical region, and striking down the superior members, with tinglings in the fingers, and then abolition of all movements. *Nevertheless the sensibility of the skin remained intact, and there did not exist any trouble of micturition or defæcation.*

Four days after the début, the fever disappeared; but the paralysis persisted during two months and a-half, after which the inferior members commenced, progressively to recover their motility, with the exception of the flexion of foot upon the leg, of the left side. About the third month, certain movements appeared in the upper extremities; at that period the spinal pains which for a month past had diminished in intensity, had completely disappeared, but the upper extremities were atrophied, especially on the right side at the level of the shoulder, of the arm and of the thenar eminence.

“Six months after the commencement of her illness, the young lady was sent to me (says Duchenne) from the provinces, and at that time I established, 1st—That the motility had returned in the motor muscles of the lower limbs, except the right tibialis anticus, which was atrophied, and which had produced upon that side a commencement of equinism. 2nd—That in the right upper extremity, the deltoid the infra-spinatus, the flexor of the forearm upon the arm, the inter-ossei and the muscles of the thenar eminence did not contract, either by the stimulus of the will or of the electric current; that the muscles, especially the posterior third of the deltoid were atrophied; that on the opposite side, the paralysis was localised in the serratus magnus and in the flexors of the fingers.”

“The state of that young lady, has been very much ameliorated

(1) Duchenne—L'électrisation localisée 3rd. Edn., p. 438.

“by localised faradisation of the atrophied muscles. But the deltoid
 “and the short abductor of the thumb on the right side and the
 “tibialis anticus on the left side, as yet give no signs of life, after
 “twenty séances. The microscopic examination of a portion of the
 “latter muscle, which I have taken by the aid of my ‘emporte
 “pièce histologique,’ has proved that there was an assault of
 “degeneration.”

A case which fell under my own observation was the following:—
 George M. , a young man of 18, an engine fitter, had
 in the course of his employment to be exposed to the effects of
 heat and moisture at the same time, in effecting some repairs to an
 engine in a building, where at the same time another engine was at
 work. After two days work at this employment he was seized
 with shivering, and this was followed by fever, and pains in the back
 and limbs, he went home at night in this state, and took some hot
 spirits and water and went to bed, but he did not sleep well, waking
 with starts, and feeling very strange and uncomfortable.

In the morning he felt sluggish and indisposed to move, but
 thought that he had got a bad cold, and by remaining in bed he
 would soon be better; the following night, he found that he could
 not get out of bed and called a mate, who slept in the same room
 to help him, and he was assisted from the bed for the purpose
 of passing water. The next morning he woke after a heavy sleep,
 and found that he could not move his legs; the sensibility was not
 diminished at this time, that he noticed. It was some six weeks
 later that he was brought under my notice, at that time the left leg
 was recovering somewhat and the muscles of the thighs on both
 sides the body, responded to faradisation, but the anterior and
 external group of the right leg, gave no response either to the
 galvanic of the faradaic stimulus. The sensibility was not at all
 appreciably diminished, the atrophy had not yet set in, but there
 was marked lowering in the temperature, and the skin was reddish
 and mottled. Shortly afterwards this case was lost sight of, through
 the removal of the family to the north.

There are other cases published by Duchenne, under the title of

Acute Anterior Spinal Paralysis and Subacute General Anterior Spinal Paralysis, (1) but many of these latter appears to me to lack the characters of the regressive paralysis and to approach more nearly to the characters of the progressive muscular atrophy.

Charcot published several cases. (2) Dr. Cumming, of Belfast, published a case, (Dublin Quarterly Journal of Medicine, 1869) and Seguin, of New York, has recorded several, (Spinal Paralysis of the Adult, New York, 1874,) and he remarks that the study of twenty-two cases which he had collected, in thirteen the loss of voluntary motion, came on in an acute way, in others, eight in number, the palsy came on gradually, in two of these so slowly as almost to deserve the designation of chronic. In two cases, the organs of deglutition and speech were affected. "A striking feature to be noticed in nearly all the histories is the retrocession of this paralysis, and the return of voluntary movements in certain parts."

I venture to believe that where this retrocession was not observed, this had occurred early, and been overlooked, or perhaps in one or two, the cases were really in the category of Progressive Muscular Atrophy or Wasting Palsy, and not belonging to those now under consideration. Indeed one of these is a case so classed by Hammond, (3) and which to my mind appears to have been correctly so classed. This writer proceeds—"Acute Spinal Paralysis.—This resembles infantile spinal paralysis in a most wonderful way," and he proceeds to recount the symptoms as previously related and then says "when speaking of Pathological Anatomy, I expect to convince you *that the diseases are identical*. The italics are mine.

So also Charcot, Leçons sur les Maladies du Système Nerveux, Paris, 1872, p. 63. "Adult spinal paralysis resembles that of infancy

(1) Duchenne—Loc cit, p's. 437 and 459. (Paralysie spinale antérieure aiguë de l'adulte) (par atrophie des cellules antérieures de la Moelle.)

(2) Charcot—"Considérations sur l'atrophie aiguë des cellules motrices" par Alfred Petitfils, Paris, 1873, p. 72, et seq.

(3) Hammond—Diseases of the Nervous System, p. 666.

“by the almost sudden invasion of motor paralysis, by the tendency which it shews to retrograde at a given moment, by the diminution or abolition of faradaic contractility, shewing itself at an early period (*hâtivement*) in a certain number of paralyzed muscles, and finally, by the rapid atrophy which these muscles constantly undergo, to a more or less pronounced degree.

OF THE DIAGNOSIS OF THE REGRESSIVE PARALYSIS.

The diagnosis of this disease presents the greatest difficulty at the onset, the febrile conditions, the convulsions, the preceding diseases or irritations, are common causes, and conditions, which may result in diverse manifestations. When the paralysis has occurred, the symptoms are explained, and the nature of the case becomes more evident. The characteristics of this form of palsy are briefly as follows :—

1st—A brusque and sudden access, in the midst of a state of health, generally good, and often after some exposure, or evidence of reflex irritation; generally preceded by a feverish attack, (which, however, in some cases, may be so fleeting as to be unobserved); by convulsions, or by some illness, diarrhœa, measles or smallpox.

2nd—The want of proportion, between the accidents of the onset and the extent or permanence of the resulting paralysis. (This is more especially to be noted in the infantile form.)

3rd—The paralysis is generally complete, and attains its maximum at once, but this is not invariably so, in the infantile form, several recurring attacks, may succeed each other, so as to give the appearance of a gradual increase in the paralysis, and in the adult, several cases are recorded in which it has gradually attained its full height. (1) This also is what might have been expected, *a priori*, from the more fixed and steady condition of the nervous system of the adult, as compared with the mobile and excitable condition in infancy, especially during the period of dental evolution.

(1) Seguin—Spinal Paralysis of the Adult, New York, 1874.

4th—The gradual regression. The akinesis gradually recedes from some of the muscles here and there, and finally becomes localised in certain muscles of a limb, or in certain of a set under the same nerve supply, picking out as it were one or two and leaving the rest free. This regression I look upon as the characteristic and necessary symptom, never absent from cases of this form and depending for its existence upon the very nature of the morbid action, which causes those permanent lesions of the nervous elements upon which the disease depends; and it may be complete.

5th—The continuance of unimpaired sensation, and in the early stage the absence of all rigidity or contraction in the affected limbs. To this may be added, the occasional existence of a degree of hyperæsthesia, in the earliest stage, more frequently observed in the adult than in the infant, probably because this early stage is more fleeting in the latter.

6th—The enfeeblement in the first instance, and gradually the loss of contractility, to the faradaic stimulus, in the affected muscles and in those definitively paralyzed, the loss of contractility to the galvanic current. The return of the power of response to the former, in the muscles from which the affection recedes.

7th—The deformities which result, from the partial abolition of movement, in the limbs affected; and from the retarded growth and impaired nutrition, which are the results of the nervous lesion to which the permanent paralysis is due. And lastly—The peculiar spinal lesion, atrophy of the great motor ganglion cells of the anterior cornua of the spinal cord; on the side and at the level of the origin of the nerves, which supply the affected limbs.

I have not used the word retraction, to express the condition the muscles, which are left sound in the affected limb and which Duchenne considers to be active agents by their tonic force in producing the deformities of the later stages. I prefer to consider them as merely passive agents, to attribute their shortening to be merely want of growth from the absence of stimulus from the constant healthy action of their opponents, in accordance with the views expressed by Volkmann, to which I have before referred.

It would occupy too much space, and, I think, needlessly, after what I have already written, to compare individually, this paralysis, with the other forms, with which it may be confounded.

Suffice it to say briefly, that the disease with which it is most likely to be confounded is progressive muscular atrophy, the wasting palsy of Dr. Roberts, first described by Cruveilhier. (1) In this, however, we have, so far as its symptomatology extends, the exact reverse of the palsy now under consideration, the wasting occurs before the paralysis; instead of receding from a number of muscles. Wasting Palsy gradually reaches a constantly increasing number, it is progressive, not regressive; the electro muscular contractility is only lost, when the atrophy is far advanced, and the temperature is not reduced in any marked degree, nor is the condition of the skin altered; while in the form of paralysis of which we are now treating, the temperature is considerably lowered and the colour of the skin is quite changed, it becomes bluish, mottled, and liable to chilblains and other troubles indicating trophic changes. From spinal congestion, this paralysis is distinguished by the loss of electro muscular contractility, and by the succeeding atrophy. The speedy affection of the respiratory muscles and death, by asphyxia, which occur in acute ascending paralysis, sufficiently distinguish that terrible disease, from this, so very rarely fatal affection.

From the cerebral paralyses, the form now under consideration is well marked off, by the absence, in general, of the troubles of the intellect, or of the special senses; but the intimate connection between the brain and spinal cord, does not permit a hard and rigid line of demarcation; consequently we find, as I have shewn, that some cases will partake of some one or other of these symptoms, thus the speech may be affected (case 12) by the extension of the morbid action, as far as the points of origin of the hypoglossal nerve, and if it may extend so far, I can see no reason to doubt that it

(1) Cruveilhier—Sur la paralysie musculaire progressive atrophique (Bull de l'Acad de Méd, 1853, tom 18, p. 490; also Archives Générales de Méd, May, 1853, p. 561. Roberts, Dr. W. An Essay on Wasting Palsy., Lond., 1858.

may extend even higher. In other words, these two forms of paralysis may be combined, but in the regression, the higher portions of the nervous system are most likely to recover their powers.

Prognosis—This disease is rarely, we might almost say never fatal, in itself. The cases which have afforded opportunities for post-mortem researches, have fallen victims to some intercurrent or accidental malady.

The real importance of prognosis in this affection consists then in the probability of recovery and its extent.

It is here that the electric current begins to shew its great value ; wherever, in the onset, we find the electro muscular contractility preserved, even though enfeebled, upon the application of the faradaic current ; there we may expect, that the paralysis will recede from the affected muscles. Later on, when the regression has taken place, still we may hope, wherever we find that the muscles respond by contraction to the continuous, (or more correctly speaking to the galvanic current,) by patient perseverance to preserve that muscle from atrophy, and to restore to it the power of responding to the induced current and eventually to the will. Wherever the muscle does not respond to the stimulus of either of these currents, we must look upon the muscle as lost, and the limb as inevitably doomed to atrophy and its consequent deformities. But before deciding that a muscle is really so lost, we must satisfy ourselves by patient, and careful, and repeated trials, that the power of responding to the electric stimulation is really lost ; by the application of both currents, the faradaic and the galvanic ; carefully applied ; not merely to the muscle in its whole, but piece by piece, go over the entire surface of the muscle, to make sure that no fibre remains active ; ever bearing in mind that, even if but a few fibres respond, we may hope for restitution of the muscle, (see Duchenne's case, *Loc Cit*, p. 434,) where the deltoid, may be said to have been almost re-created from a few fibres. Nor must we rest satisfied with one form of this electric stimulus, if we fail with faradaic, we must try the galvanic, and as carefully, bit by

bit go over the muscles, not once or twice merely, but many times, and, even if we procure but the faintest trembling of a fibre, look upon that, as ground for redoubled exertion and perseverance. And further, if the mode of direct stimulation of the muscle itself prove unavailing, we should not despair, till we have also failed, after patient trial by the mode of Remak, (1) stimulation by means of the nerve supplying the affected muscles.

OF THE CONDITIONS OF THE NERVOUS CENTRES IN REGRESSIVE PARALYSIS.

The facts I have previously narrated are sufficient to shew, that in its symptomatic outline, the regressive paralysis, in the adult, agrees very closely with that in the infant; only allowing for the changes in activity of the various functions, which are the natural consequences of advance in years. So also is it with the pathological lesions, which are found in the nervous centres; the case of Gombault (2) would be sufficient to prove this; indeed it only needed the opportunity of examination to confirm this opinion, which was held by all, who had studied the two forms of this paralysis. (See Duchenne. *Op. cit.* p. 292-293.)

We will proceed to consider in the first place, what at the present moment, is the condition of our knowledge, with regard to the form of the disease, which has been most frequently studied, and which is by far the most common, viz. :—the regressive paralysis in infants. Probably the first systematic attempts, to enquire into the question, of lesions of the nervous system in this form of paralysis, were those of Messrs. Rilliet and Barthez, (3) whose examinations were made only by inspection, with the naked

(1) Remak—*Galvanothérapie*, Paris, 1860,

(2) Gombault—*Note sur un cas de Paralysie Spinale de l'adulte suivie d'autopsie*. *Archives de Physiologie normale et pathologique*, 1873.

(3) Rilliet and Barthez—*Loc cit.*

eye, and who, finding no lesions appreciable to the unaided sense, came to the conclusion, that the seat of lesion was primarily in the muscles, and in this belief, proposed the term Essential Paralysis; next Duchenne, in 1855, rather from reasoning, than from examination, attributed the symptoms and progress of the disease, to a Spinal Lesion, and Heine, in 1860, led by similar considerations, proposed the name, "Spinale Kinderlähmung," Spinal Paralysis of Infancy.

Flëiss would seem to have been the first to have found a distinct lesion, it was in a case of paralysis of one arm in which he discovered a congestion of the spinal meninges, at the level of the brachial plexus on the paralyzed side. So matters remained till 1864, when M. V. Cornil, a pupil of Charcot's, published (in the *Comptes-rendus de la Société de Biologie*, 1864, p. 187,) the case of a woman, aged 49, the subject of a paralysis of this nature dating from the age of two years, in which there was complete fatty degeneration of the muscles with atrophy of the primitive fibres; fatty degeneration of the nerves, with atrophy of the nervous tubule, and what is of most importance with regard to our knowledge of the true pathology of this affection, atrophy of the anterior cornua of the gray substance, and of the antero lateral columns, in the regions of the cord, whence emanate, the nerves supplying the atrophied muscles.

A case of "extreme muscular atrophy," which was evidently the result of a paralysis of this nature, in which the cord was carefully examined by Lockhart Clarke, and Dr. R. McDonnell. (1)

It was the case of a man, *cetate* 32 years, who when twelve months old, was inoculated with natural smallpox; he suffered much and screamed at night, and gave other evidence of severe indisposition; when the eruption was about its height the left arm was observed suddenly to drop and become powerless, soon afterwards the right followed the same course, so that both hung helpless, and it was a long time before he seemed to re-acquire any

(1) *Medico—Chirurgical Transactions*, vol. 51, 1868.

power over them. These symptoms were followed by atrophy of the muscles of the arms and shoulders.

After death it was found on making the post-mortem examination, that "the muscles of the shoulder and arm had almost disappeared. "The muscles of the forearm remained apparently unaffected, the "muscles of the ball of each thumb, were almost altogether gone, "while the muscles of the fingers continued to be well developed. "The muscles on the dorsum of each scapula were nearly gone also."

On examination of the spinal cord in the cervical and dorsal regions "the posterior nerve-roots were normal ; the anterior nerve-roots were in a state of extreme atrophy. The atrophy was quite marked and unmistakeable, to the naked eye, but was made very striking, on placing the portion of the cord examined side by side with a similar portion of a healthy cord.

In the part examined microscopically by myself says "Dr. R. McDonnell, there were few nerve-tubules remaining in the roots."

Lockhart Clarke found "the most unequivocal evidence of extensive lesions in both the white and gray substances." These he fully describes and figures. (See case of Extreme Muscular Atrophy, reported by Dr. Zach. Johnson, and examination of the Spinal Cord, with remarks by Dr. Lockhart Clarke. *Medico-Chirurgical Transactions*, vol. 51, 1868.)

He then proceeds to say "although some of the nerve-cells retained their normal size and appearance, a great number were found to be in different states of atrophy and disintegration." "There was much softening and infiltration with granular exudation and the pia mater was also thickened and infiltrated with fluid exudation. Previous to this, however, (in 1866) a case of this nature, and probably dating from infancy, was examined by MM. Vulpian and Prévost, and reported in the *Comptes rendus de la Société de Biologie*, for 1866, (p. 215,) in which the examination shewed, that in the segment of the cord corresponding to the atrophied muscles, most of the cells had disappeared from the anterior cornua, and at the points which they had occupied the neuroglia exhibited the sclerotic transformation.

But the full meaning of these changes, and their relation to the pathology, of the disease we are now considering, was reserved for the researches of M. Charcot and his "interne," M. Joffroy.

The case was that of a woman named Wilson, who had been struck with a paralysis of this nature, at the age of seven years, attacking all four limbs, and whose muscles had rapidly atrophied, and her limbs having undergone a remarkable arrest of development, exhibited the characteristic deformities. She had been retained as nurse at the Salpêtrière, and died from Phthisis Pulmonalis, at the age of 45 years. "In all the regions of the cord, the great motor cells were profoundly altered, although in different degrees, and at the points most seriously affected entire groups of cells had disappeared, without leaving any traces. Almost always, the neuroglia had undergone the sclerotic transformation, in the immediate neighbourhood, and within a certain distance from the injured cells; but there were points,—it is a fact which demands enquiry—where the lesion of the cells, was the only alteration, proved by the histological examination. The connective tissue in those points preserved its transparency and nearly all the characters of normal structure." (Charcot—Leçons sur les Maladies du Système Nerveux, Paris, 1874, p. 164.)

The writers point out also, that there was atrophy, with partial sclerosis of the anterior lateral columns, and very marked atrophy of the anterior roots, especially remarkable at the level of those regions of the cord, most profoundly affected. This observation was published in 1870, (Société de Biologie, et Archives de Physiologie, 1870,) and the writers state their belief that this lesion of the motor nerve-cells of the anterior cornua, "*is a fact, constant in Infantile Spinal Paralysis, and from which are derived the principal symptoms of that malady,*" especially the paralysis and atrophy of the muscles. They also express their opinion that it is the initial anatomical fact, and that the lesions of the neuroglia and the atrophy of the nerve-roots, should be considered as consecutive phenomena. (See figs. 4 and 5, after Charcot.)

Since this time further examinations have supported this view.

MM. Parrot and Joffroy recognised the lesion in the case of a child in which the disease had scarcely lasted one year. (*Archiv. de Physiologie*, tom 3, 1870) In a case reported by M. Vulpian, (*idem*, tom 3) and in two other cases observed at the "Hôpital des Enfants," by M. Damaschino, (*Gazette Médicale*, No. 3, Oct., Nov., and Dec., 1871,) and says Charcot, lastly, the same lesion exists most distinctly, in three new cases recently collected in my "service," and the anatomy of which has been carried out with great care by my pupils MM. Michaud and Pierret. Although in certain cases or at certain points of the cord in the same case, these lesions invade a considerable part of the gray matter, and sometimes extend to the antero lateral columns, yet at others, they remain exactly limited to the anterior cornua, and sometimes do not even occupy that, in its whole extent, but may be seen localised, and exactly occupying an oval space, corresponding to a group or aggregate of the large motor cells. (See fig. 5, after Charcot.)

He proceeds to argue, that the alteration commences in the great motor nerve-cells, as special organs endowed with proper functions; and states that the changes shew themselves more markedly in the immediate vicinity of the cells, than in the intervals which separate them, and are more marked in the central parts of an aggregate of cells than in the circumference. So that there appear to be foci, or centres from which the morbid action, has spread to a certain distance in all directions, and thus reasoning by analogy, these are strong grounds for believing the extension of the morbid changes to the antero lateral columns to be a consecutive and purely accessory process.

The question will here arise, as to the nature of the process, the results of which manifest themselves in this change, and disappearance of the great motor nerve-cells.

Here we find a clue in the facts recorded by MM. Damaschino and Roger, (*Gazette Médicale*, Oct., Nov., and Dec., 1871) where they found in two children, who died, one six months, and the other two months only after the accession of this paralysis, a red

inflammatory softening of the anterior cornua, with vascular injection, production of granular bodies, &c., &c., in the parts of the cord most profoundly affected. Above and below these points the alteration could still be perceived, for a certain degree in the gray substance, but progressively attenuating, until it was represented only, by a multiplication of nuclei and vascular injection, most marked in the immediate neighbourhood of the nerve-cells.

Another, and most interesting fact, which was proven by these observers, was that in its early phases, the alteration of the nerve-cells, is marked by atrophy, with excessive pigmentation of their elements. The sclerosis seems to have been a consecutive phenomenon. (Vide Roth. *Anatom. Befund bei Spinaler Kinderlähmung*, Virchows Archiv., 1873, tom 58, p. 273.)

The changes which occur in the nerve-cells are as follows :—

1st—"A tumefaction after enormous, the body of the cell
"voluminous as though swollen, and at the same time troubled and
"opalescent, the prolongations further apart than in the normal state,
"and appearing as though contorted. I have compared that alteration
"of the nerve-cells of the spinal cord, to the hypertrophy, which,
"under the influence of certain irritative processes, the axile cylinder
"of nerve-tubes presents, sometimes in the cerebro-spinal centre,
"sometimes in the peripheral nerves. (Fig. 6, B.)

2nd—"Some authors have described a multiplication of nuclei
"in the nerve cells of the encephalon (Jolly) which they have
"considered as the mark of an irritative process. M. Leyden is said
"to have made the same observation upon the ganglionic cells of the
"cord. But it is necessary to remark, that in certain regions
"of the encephalon, and in the sympathetic system, the presence
"of two nuclei in one nerve-cell, is a fact, rare doubtless, but
"which is seen in normal conditions, apart from any trace of
"irritative process. For example, we do not know any proliferation
"of the nerve-cell, corresponding to the proliferation of the
"cellular elements of the connective tissue. In short the
"different alterations which the cells undergo, by the fact of
"inflammation, apart from the swelling described above, are all,

“anatomically speaking, atrophic and degenerative.

3rd—“I have described in passing the alteration called *vacuolaire*, of the nerve-cells of the anterior cornua. I have many times met with it in cases where the neuroglia presented in the neighbourhood, unequivocal characters of inflammation. I have not, however, as yet been able to convince myself that it is not a production of art. (Fig. 6, F.)

4th—“I have long insisted upon the alteration, called pigmentary, of the spinal nerve-cells. It is so to speak, a normal fact in old age, that they should be filled and distended, often with an enormous quantity of pigment. Is it then a circumstance altogether indifferent from a functional point of view; may not, for one thing, the motor enfeeblement, and the alterations of the muscles of the limbs, which shew themselves, so to say, fatally, at a certain epoch of life, be accounted for by that senile modification of the cell? The accumulation of pigment in a spinal nerve-cell, may not suffice to account for all the marks which characterise a profound lesion of the organism. But there is joined to it, in the cases properly called pathological, a true atrophy, which Lockhart Clarke has well described in all its phases.

“In the first degree of that alteration, the cell diminishes in volume, and the transparent part of the body becomes reduced more and more. In the second degree the prolongations atrophy in all their length, and at the same time the body takes a globular shape. Presently the prolongations are only represented as short and slender filaments.

“Lastly, at the furthest degree they disappear. The nucleus of the cell undergoes a concomitant atrophy. The pigmentary atrophy, which conducts to the total destruction of the cell, shews itself bound up with the irritative processes, primitively developed in the neighbouring neuroglia; otherwise these exist isolatedly, independently of all lesion of the neuroglia; in certain cases, for example, of Progressive Muscular Atrophy

"or of Bulbar Paralysis. (Fig. 6, C. D.) (1)

5th—"A last form of alteration of the motor nerve-cell, is that which has sometimes been designated by the name of sclerosis, or of sclerotic atrophy. The cell has diminished in volume, is sometimes considerably shrunken, more or less rounded, or on the contrary elongated. The prolongations are short, dried up, or absent. The cellular body is opaque of brilliant aspect; the nucleus is small, unequal, and shrunken. I do not know whether these alterations are always preceded by the lesion of pigmentary atrophy or whether they may be primitive. They are frequently met with in cases of amyotrophy spinale, in connection with well marked irritative processes. (Cours de la Faculté, 1874) (Note to p. 184. Charcot's *Leçons sur les Maladies du Système Nerveux.*)

The researches made by Lockhart Clarke, Dickinson, (2) and Vulpian, upon the condition of the cord, after amputation of the limbs of old date, shew that the changes in the nerve-cells are of a different character, and that it is the atrophy of the anterior columns, &c., in short the lesions which we have previously shewn to be consecutive and secondary, which are brought about by the

(1) Fig. 6 shews—After Charcot.

A—Normal ganglion cell of Anterior Cornua.

B—Hypertrophy of " " "

C—Pigmentary alteration of " "

D— " " at its latest stage.

E—Sclerotic atrophy of ganglion cell.

F—Vacuolaire change of " "

(2) Dickinson, W. H.—The changes in the nervous system which follow the amputation of limbs. *Journal of Anatomy and Physiology*, vol. 3, 1869.

Vulpian, A.—*Archives de Physiology, normale et pathologique*, No. 3, May to June, 1868. *Examen de la moëlle épinière dans des cas d'amputation, d'ancienne date.*

inertia, which itself is the result of the alterations in the great motor nerve-cells.

Certain experiments upon animals also under the hands of M. Prevost, have shewn that a lesion of the central parts of the cord, will determine muscular lesions very like those which are observed in the paralysis of young children. (Prevost—*Société de Biologie*, 1872.)

The changes which result from mere inertia, of the cord, as in cases of amputation of old date, are well given by Dickinson, as follows :— (1)

1st—"Atrophy of the nerves of the stump, of which always a "large proportion of fibres have perished, notwithstanding that "supported by the fibrous tissue, which enters into their structure, "they retain their bulk and external appearance almost without "alteration.

2nd—"Wasting of the nerve-roots, especially the posterior, the "wasting of the tubes, in the absence of such fibrous investiture as "belongs to the mixed nerves, produces an attenuation, which in "the case of the posterior root is very conspicuous.

3rd—"A slight loss of bulk in the gray matter of the cord on "the side of the lost member, near the origin of its nerves, without "any intimate change discernible by the microscope."

"Lastly, a remarkable shrinking of the posterior columns of the "cord, on the side of the mutilation, attended by a condensation of areolar tissue."

Vulpian (2) gives results which differ slightly; the atrophy of the posterior nerve roots and posterior columns of the cord, which was noticed by Dickinson, was not noticed in Vulpian's cases, in all other respects they coincide.

These changes in the nerve-cells, Charcot believes, and apparently with good reason, to be the first point of departure, of the irritative process and that by it is produced what he calls an acute

(1) Dickinson—*Loc. cit.*

(2) Vulpian—*Loc. cit.*

anterior parenchymatous tephro-myelitis (téphro-myéélite antérieure aiguë parenchymateuse.) Kussmaul (aus der medicinischen Klinik der Herrn. Prof. Kussmaul, No. 1, p. 3,) gives it the name of "Polio-Myelitis Anterior Acutissima." The process, whatever be its true nature, communicates itself rapidly to the surrounding tissue, but does not pass the limits of the anterior cornua. Under its influence the cell undergoes the different stages of atrophy ending in complete destruction, and the neuroglia becomes inflamed and altered in its turn. The centrifugal nerves, taking origin from the affected parts, are then in the condition of a nerve which has been divided, and undergo changes analogous to those, which occur in one which has been cut, and the loss of faradaic contractility, and atrophy of the muscular fibres follow in their suite. Such is the probable nature of the lesion and its mode of progression, but it is to be remembered that as yet, it has not been proved by actual inspection in the earliest stage of this affection. By reference to the case of Gombault, it will be seen that so far as researches have at present shewn, the lesion in that form of this paralysis which effects the adult is of the same nature. His account is as follows:— (1)

"As regards the alteration of the ganglion cells, it exhibits the "same characters, as are met with in the progressive atrophy of these "cells. Although the cell degeneration is everywhere well marked, "it is nevertheless possible to follow it, in its various stages of "development in one section. Close to cells, which seem quite "normal, are seen others containing a small amount of yellow "pigment. In other cells, this is so abundant, as to surround the "nucleus and nucleolus, though these structures are still visible. "At this stage the cells tend to assume a globular shape. In a "still more advanced degree of degeneration the cell processes are "shrivelled, or are even absent, the nucleus disappears, and the "only thing left of the cell, is a small rounded body filled with "yellow granules, and surrounded by a thick envelope which is

(1) Gombault—Loc cit.

"stained with carmine. In some cells which still retain processes, "these latter structures may be traced as continuous with the stained "envelope. The alteration is diffused, it has affected cells here "and there, and a number of these bodies must have disappeared, "since in some sections from the cervical region it is not possible "to count more than 15 or 20 cells. The external and posterior "group in the cervical and lumbar enlargements seems to have "been attacked by preference. Throughout the whole anterior "gray matter there are altered cells. The lowest portion of the "cervical region seems to have suffered most. The cells which do "not exhibit pigmentation, appear to bear some trace of the lesion "which must have affected them at some anterior period. They "have undergone for the most part, a reduction in size, and there "are very few measuring 0.066 m.m., a size below the average for "the ganglion cells of the region."

Some writers (1) have held that these lesions and alterations of the nerve-cells, and neuroglia, are secondary changes consequent upon the previously determined atrophy of the muscles which they supply, but it is well shewn by Lockhart Clarke (2) that, though as has been already remarked, the portion of the cord, and the nerves which supply a lost limb, will, after a number of years, undergo a very decided atrophy, it is apparently in different places, and to a different

(1) It must be noted that Dr. N. Friedreich, Professor of Medicine, in Heidelberg, in a work published by him, in 1873, "*Ueber progressive Muskelatrophie, über wahre, und falsche muskelhypertrophie*," Berlin, 1873, urges a contrary view to that upheld by Charcot, and most recent observers, that the changes in the nerve centres, are secondary to the muscular lesions, and he quotes Vulpian's case in support. But it has been shewn that the lesions there found in the anterior ganglion cells, did not coincide with the points of origin, of the nerves supplying the amputated limbs, and that they form an isolated fact, not supported by later observers.

(2) Lockhart Clarke and Dr. Zach. Johnson—Loc cit. "Case of Extreme Muscular Atrophy."

extent, and though it is not improbable that atrophy of muscles, progressing through a lengthened period, might give rise through partial abolition of the functions of the nerves and nervous centres which supply them, to a simple atrophy of those parts; yet it is highly improbable that muscular atrophy could be the cause of those granular degenerations, and morbid changes, which are characteristic of this disease, and he says "the absence of such lesions in cases of lost limbs is strongly in favour of this conclusion.

Referring then to Vulpian's case, he says that though "M. Vulpian detected in one solitary spot, what appeared to him to be three small areas of disintegration," yet this only "seems to be an exceptional instance," and "was found far distant from that portion of the cord, which supplied nerves to the lost limb." (*See Note.*)

Taking it then as proven to our satisfaction, as it certainly is to that of the majority of observers, that the muscular and trophic lesions are secondary. Let us enquire how these are brought about? We know from ample experience that in cases of ordinary hemiplegia, the muscles neither waste nor degenerate, but will respond to irritation just as those on the sound side. In cases of paraplegia also, from a localised lesion in the upper part of the cord, if the cord below the lesion remains healthy, the paralyzed muscles undergo no sensible change in this regard. We know on the other hand, that "in paralysis from, division of, pressure on, "or disease in, a nerve trunk, wasting and degeneration of muscle "is the inevitable result. In destructive disease of the cord, "whether acute or chronic, whether due to inflammatory change "in the cord itself, or pressure from thickened membranes, or "hemorrhage, wasting and degeneration of muscle will inevitably "occur. This wasting will take place if the motor tracts of the "cord be alone affected, and if the destructive change be limited "to the anterior cornua, as is the case in infantile paralysis or "spinal paralysis in the adult."

"When the destructive changes are limited to the sensory tracts, "such as the posterior nerve-roots and posterior columns, as is the

"case in the early stages of Locomotor Ataxy, no wasting or "degeneration of muscle occurs." (So speaks Dr. G. V. Poore, in a paper published in the *Lancet*, May 19th, 1877, on the trophic changes which follow lesions of the nervous apparatus. He omits Cruveilhier's atrophy and pseudo-hypertrophic paralysis as not yet sufficiently known.)

There is also abundant evidence that a morbid condition of nerves depending upon wounds, pressure, or some other form of irritation, will produce various diseases of the skin, and even ulceration of the subjacent tissues. (1) "The writings (says "Lockhart Clarke (*loc cit*, p. 259) of Henle, Rayer, Bärensprung, "Notta, Swan, Parrot, Charcot, Paget, Earle, and others, record "numerous instances of the kind. It is well known how commonly "neuralgia is followed and accompanied by Herpes, which some- "times takes the course of particular nerves, as the inter-costal or "lumbar, and Dr. Anstie has shewn that it is sometimes followed by "erysipelas." Dr. Hugh Ley long since remarked that leech bites "induced erythema and ulcers in the skin of neuralgic subjects.

(1) Henle—*Handbuch, Ration, Pathologie*.

Rayer—*Maladies de la Peau*.

Bärensprung—*Annalen der Charite Krankenhaus zur Berlin*.

Notta—*Mémoire sur les lésions fonctionnelles, qui sont sous la dépendance des nevralgies*. *Archiv. Gén de Méd*, 1854.

Swan—*Diseases and Injuries of Nerves*.

Parrot—*Considérations sur le Zona*. *Union Médicale*, Mars, 1856.

Charcot—*Note sur quelques cas d'affection de la Peau dépendant d'une influence du système nerveux*. *Journal de Physiologie*, tome deuxième, 1859.

Paget—*Lectures on Surgical Pathology*.

Earle—*Med. Chir. Trans.*, vol. 7; and *Woake's Journal of Cutaneous Medicine*, 1867.

"Rayer records a very interesting case in which traumatic neuralgia arising from a gun shot wound in the thigh, was accompanied at intervals by herpetic eruptions on the skin. Rouget has related a similar case. In like manner the process of nutrition in muscles may be perverted and impaired by disease or injury of these nerves."

"Now, he proceeds, if functional derangement, or irritation of nerves will give rise to atrophy of the muscles which they supply, it is reasonable to infer that some kind of functional derangement of the nervous centres, which give origin to those nerves, may be followed by similar effects; so that although there are the strongest grounds for believing, that the lesions of *structure*, which I have described in the nervous centres of cases of muscular atrophy, are the causes of that atrophy, it does not therefore follow that, every case of muscular atrophy is the consequence of those *structural* lesions, or even of *functional* disturbance of the nervous centres,—since it may be due to affections of the nerves alone."

These remarks agree with the opinions expressed by Charcot and Brown-Sequard, but Dr. Poore in the paper already quoted, thinks that this is an error, and offers another explanation. He believes "that a muscle is never, in health, absolutely still, but that minute reflex movements are constantly going on," and he quotes Hermann's Physiology, p. 488, for an experiment of Brondgeest's, which seems to support that theory. "If a frog be vertically suspended, after having its brains separated from its spinal cord, and the nerves of one of its hinder legs be divided, it will be noticed that the injured leg hangs more loosely than the uninjured one. The same result follows, if instead of dividing the whole sciatic plexus of nerves, the posterior roots alone be cut. Hence it must be concluded, that the slight flexion of the uninjured limb, is not due to an automatic but to a reflex action, which is liberated by means of the sensory fibres of the limb, and the necessary irritation of which appears to proceed from the skin."

"If, he proceeds, the anterior nerve-roots, or the cells in the

“anterior cornua (as in infantile paralysis) be destroyed, then not only is the power of voluntary movement abolished in the muscles supplied by the part, but (the road by which impressions arriving at the level of the cord, being blocked) the power of reflex stimulation is abolished also, and the muscles rapidly waste and degenerate.”

“Lastly, he continues, in a case of ordinary hemiplegia, the power of reflex stimulation remains intact and the muscles neither waste nor degenerate.” He then proceeds to consider the matter from the point of view of clinical experience, and remarks, that in infantile paralysis, and also in spinal paralysis of the adult, (the two forms, of what I have ventured to call regressive paralysis,) vaso motor changes are strongly marked. The skin over the paralyzed muscle is congested and the temperature much depressed, and he thinks it probable, that as the lesion of the motor nerve-cells prevents motion, both direct and reflex; so also it probably prevents any reflected stimulus, travelling to the sympathetic, along those fibres which accompany the anterior nerve-roots.

But again we must bear in mind, that this is only hypothetical, while Vulpian has shewn by experiment, that injuries of the gray matter of the cord, were not followed by atrophy, and he concludes, that when atrophy of the muscles does so follow an injury, it must be due to its irritating nature.

Brown-Sequard also confirms this opinion, in commenting on M. Charcot's cases of affections of the skin depending on the influence of the nervous system, he shews the difference of effect, between the *simple section or cessation, of action* of nerves, and their irritation. Simple section of a nerve is not followed by any other alteration of nutrition, than slow atrophy of the paralyzed parts. It is the same with the spinal cord. He has seen animals live for months, after section of the spinal cord, without presenting any other lesion of nutrition, than a slow atrophy of the paralyzed parts; whereas in two cases, in which exostoses formed at the point where the cord was divided, and compressed its lower end, considerable atrophy of the muscles supervened in the course of five or six

days, with gangrenous ulceration over the sacrum and some parts of the thigh.

The lesions found in the brain are not peculiar to this paralysis, they may be regarded rather as complications, or remains of a morbid irritation of the whole cerebro-spinal centre. When they are present, it is usually in the form, of a hyperhæmic condition of the meninges, and there may be some congestion of the cerebral mass itself, more probably in the gray matter than in the white, and as a consequence of this, in cases of old standing, we may find traces of sclerosis or myelitis. Laborde found in two cases a little reddish serosity in the lateral ventricles, and Vulpian a slight softening with adhesion of the pia-mater, near the fissure of Sylvius and hæmorrhage in the corpus striatum and optic thalamus of the left hemisphere.

In the medalla oblongata, there may be cellular atrophy in the pyramids and on the floor of the fourth ventricle. A prolongation upwards of the characteristic lesions of the cord.

ON THE TREATMENT OF THE REGRESSIVE PARALYSIS.

The treatment of this affection naturally divides itself according to the three principal epochs of the disease. Thus the treatment in the initial stage, that in the second or paralytic stage, and thirdly, that in which the paralysis has become localised and definitive in its character. In the first stage, we have to combat these febrile symptoms, and so far as we have means, to endeavour to limit the extent of the irritative process, and of the consequent morbid change. In the second stage, when the febrile or inflammatory changes of the onset have ceased, our object must be, to prevent any muscles from becoming atrophied from disuse, by using all the means in our power to stimulate such of these as have not entirely lost the power of responding to a stimulus; so that their proper structure shall not change but shall be kept in a condition fit and

able to respond to the stimulus of the will, should the central change not prove to be permanent.

In the third stage, our attention can only profitably be bestowed upon the endeavour to aid, or supply substitutes for, the weakened or atrophied muscles, and to prevent, so far as possible, the formation of deformities, by the changes which take place in the muscles left sound, so far as the paralysis extends, but which have lost the stimulus, which in health is afforded by the action of their opponents.

It is in the first stage, and in that only, that counter irritants and revulsions, can be expected to be of much service ; and in the infantile form it is but rarely that the case comes under the notice of a competent observer at this stage.

In the adult form, the case is more likely to be seen, and its true nature discovered, in time to be of use ; and in the "*Mémoires et comptes rendus, de la Société des sciences Médicales de Lyon.*" *Comptes rendus*, p. 28. A case of cure is recorded by M. Lemoine, where a speedy cure followed the use of the actual cautery, along the vertebral column and especially about the prominence of the sacrum. Blisters and moxas have also been used at this stage with good results ; "*la cauterisation ponctuée, tres legerement faite,*" flying blisters of small extent, and the application of the *Pigmentum Iodinü*, are all measures which have been tried and which must of necessity suggest themselves to the practitioner.

It is in the second stage, that the value of the electric current becomes very evident, and here also it is, that we can hope for help from the nervine tonics. Phosphorus, in its various forms and strychnia, either by the mouth or as subcutaneous injection may be used in this stage, with a prospect of good. Frictions, with stimulant and aromatic liniments are useful, but the stronger irritants, as cantharides, croton oil, or phosphorus (Heine) are not necessary and not useful here ; they are needed, if at all, in the first stage. Excitant and tonic baths, salt or sulphurous, sea water, &c., are very valuable, local douches and vapour baths find their place here.

Hydrotheraputies, rationally used and carried out under honest and intelligent supervision, are of great value, and lastly, but by far the most important of all, the means within our reach—Electricity.

I cannot do better in this place than quote the words of Sir James Paget, in a lecture delivered at St. Bartholomews's Hospital, February 6th, 1864, when speaking of paralysis, not complicated with inflammatory hardening of textures, he says—"The main design of the treatment, must be to maintain the nutrition of the limb notwithstanding its inaction. And for this purpose, there must be maintained, in addition to whatever may be required, for the maintenance of the general health.

1st—"Constant warmth of the limb; the whole body must be warmly clothed; the paralyzed limb and its fellow especially so. No good or quick repair will take place in a cold limb.

2nd—"Regular friction and shampooing, especially circular shampooing.

3rd—"Localised galvanism, that every paralyzed muscle may be made to contract,"—to which I would add the qualification—if possible.

4th—"Constant voluntary efforts; constant endeavours to attain every lost movement, and whenever any such endeavour is effectual, frequent exercise of the recovered power.

5th—"Swedish gymnastics, *i.e.*, set exercises, for each muscle in which power is not wholly lost.

6th—"Guard against distortion from unbalanced action of muscles, especially contracted fingers or elbows.

"With these things patiently, that is year after year continued, much good may be achieved."

Of the various modes of raising the temperature of the paralyzed limbs and of the various modes of using friction, I may quote a short summary given by Dr. Roth, (on Paralysis in Infancy, Childhood and Youth, London, 1869,) p. 83, cap. 62. "The various means for raising the temperature of the paralyzed parts."

1st—"The position should be attended to, in all cases; a paralyzed part should not be permitted to hang down, and to dangle about; it should be placed in a horizontal position, and the coldest part should be the highest, which assists, the reflex of venous blood.

2nd—"Clothing. Spun silk, a mixture of silk and wool, wool or fur garments, should be worn next to the skin; it is only in exceptional cases, that the hyperæsthesia of the cutaneous nerves, does not permit any of these materials to be used. Here silk is placed next to the skin, and wool or fur over it. The paralyzed parts should be well warmed before it is covered with bad conductors of heat.

3rd—"Dry heat, is conveyed by exposing the part to the direct rays of the sun; to radiating heat or a good chimney fire, for this purpose a screen is placed before the fire, and through a hole in the screen, the cold limb is exposed to the heat, which in this way does not inconvenience the rest of the body.

"It should thus remain until it is very warm; bags filled with, or baths of hot salt, flour, or sand, are also used, as well as vulcanized india-rubber bags, filled with hot water. The Turkish baths afford the means for conveying *dry* heat to a very high degree.

4th—"Moist heat is applied by means of fresh or salt water baths by douches, showers, hot flannels, and cloths dipped in the water, well wrung out and applied to the paralyzed parts; oiled silk, or other impenetrable materials, are placed over it. The Russian bath is one of the best modes for conveying moist heat.

5th—"Junot's Exhausting Apparatus," (which he does not describe.)

6th—"Electricity.

7th—"Manipulations, or various movements applied by another person on the cold parts of the patient; oscillation, vibration, kneading, pulling, rotation, percussion, pressure, palpation, tapping, chopping, longitudinal and transversal friction, on a large or small

“surface, with the palmar surface of the fingers or the palm of the hand, or with the whole palmar surface of the fingers and hand ; the so-called shampooing, (massage) and its manifold operations belong to those means, which not only produce an increase of temperature in the cold limbs, but also indirectly contribute to the improvement of the nutrition.

8th—“Active exercise of all parts which can be moved, and especially of those which are nearest the paralyzed parts.

9th—“Applications of cold on the spine in the form of wet or dry cold compresses, of ice in the spinal bag.

10th—“The application of a mineral magnet.

11th—“The friction of the paralyzed part with a hand dipped in cold water, till the water evaporates, often causes a sensation of warmth and a kind of glow in the paralyzed part ; for the same purpose a towel dipped in cold water and well wrung out, is thrown on to the cold part and the passive movement called fulling, is continued till the towel and the cold part become warm.” (1)

As to the manner of using the electric current, space will not permit me to go into all the minutiae of the various modes, for which I must refer the reader to the special treatises of Duchenne, of Remak, of Meyer, and of Ziemssen, and in English, the works of Althaus, of Reynolds, or of Poore. Sufficient to say, that the localised application of both currents, after the mode of Duchenne, is almost always required, the rheophores being applied, an inch or so

(1) On this subject further reference may be made to the following works :—

Delamarre—“*Sur les frictions seches*,” Paris, 1829.

Grossmann—“*De frictione medica*,” Leipzig, 1834.

Balfour—“*On Friction*,” 1819.

Cleobury—“*On the Rubbing System*, by Grosvenor, of Oxford,” 1825.

Beveridge—“*The Cure of Disease by Manipulation*,” Edn., 1859.

Johnson—“*The Anatriptic Art*,” London, 1860.

Lainé—“*Du Massage*,” Paris, 1869.

apart, over the whole surface of the muscle, bit by bit ; and that a larger battery power, than is generally used for the production of the induced current in England, seems to me to have advantages in this form of treatment, two or three or four cells being used. Next, that with the galvanic current, it has been useful in my own experience, in cases in which the muscular reaction was very feeble, and almost extinct, to make frequent interruptions, as by means of a cogwheel, the teeth of which bear upon a spring ; and also in many cases, by frequent reversals of the poles.

When the localised application of these currents fails to produce a reaction, we must, as I have said before in treating of the prognosis, try the mode of stimulation by means of the nerves, advocated by Remak, and above all, we must not too easily despair, but give time and trouble for many days, before we pronounce a case to be hopeless.

I have often found it desirable to use the continuous current, for sometime before applying the induced, and I have met with cases in which a reaction was obtained in this way, when no other mode seemed of any use.

The instruments I have used in these cases have been for the most part Stöhrers ; and his two cell Induction Coil Machine, and fifteen cell Continuous Current Battery are very good and strong instruments for the purpose. Foveaux fifty cell Continuous Current Battery, is apt to get out of order, and is troublesome to fill, and the number of small cells, makes it difficult, to replace the plates in their proper places, when once they have been removed for re-filling.

The more recent forms of Leclanché Batteries, appear to be admirably adapted for medical purposes, being compact, portable, and containing the necessary apparatus for both the induced and the galvanic current, but I have not had any practical experience with them as yet.

The small induction apparatus of Gaiffe is of use only as means of diagnosis, of his more recent arrangement adapted for

both forms of current, I have had no practical experience. Dr. Reynold's rules for the use of electricity in paralysis should be borne in mind, as they shortly sum up, the gist of what we have previously stated, and have been well proven by the experience of competent observers.

1st—"If the paralysis to the will, remain absolute, and if the "contractility of the muscles be perfect, we do no good by persevering "with electrical treatment,"—to which I would add the qualification, —unless there are signs of atrophy or wasting of the proper muscular structure, which however is rarely the case.

2nd—"If the paralysis to the will, remain absolute, and if the "irritability of the muscles be diminished, then electricity is useful "so far as it helps to improve the nutrition of the muscles, and "restore their normal degree of irritability."

The exhibition of strychnia can do no harm, and it may be classed with the tonics which would instructively occur to the mind of the practitioner, in treating a case of this kind, the phosphates, in their various forms, and free phosphorus, in ethereal solution, (my experience is that the combination with wax, in the form of pill is quite inert.) If there should be any tender part about the spine or lumbar region, counter irritation, with seton or moxa, and free purgation, may be of use in the earliest parts of this stage.

If any intestinal irritation, such as worms, &c., be present, it must of course be removed, and the same may be said of irritation from turgid gums; in short, all means of alleviating the causes, which may lead to nervous irritation, should be used, and the general health supported, by the usual hygienic and dietary rules.

In the third stage, when the muscles still affected have become definitively paralyzed and atrophied, there is little to be hoped from any efforts, to act upon the central lesions, which exist in the nervous centres; we are then restricted to means of limiting the atrophic changes, to the smallest possible extent, and so far combating the formation of consecutive deformities. Of main-

taining the nutrition of the part, to the highest possible degree, and so limiting those trophic changes in the bones and other structures, which tend, even more than the muscular atrophy, to the production of permanent deformities, and thirdly, to endeavour to remedy by the application of suitable apparatus, the deformities entailed by the loss and atrophy of muscles and other structures.

A word here, may not be out of place, apropos of the condition of the atrophied muscles, Dr. Seguin remarks, that he has found that the tense condition of the atrophied muscles, being as it were, held on the stretch, by the constant dead weight of the limbs (or as the other theory would have it, by the condition of tonic contraction of the healthy opponents,) places them in a very unfavorable condition for exhibiting any electro-muscular contractility which may be left; and that the relief of this tension by mechanical means, or by tenotomy, or both, will often enable the muscle, which seemed to have previously lost all power of responding to the electric current, to once more contract, and be followed by eventual success. This, and the various means I have already recorded, will fulfil the first two indications, and as for the third, there is room in the various ingenious modes already advised, or which may be devised, by the practitioner with a mechanical turn of mind, for a volume.

It will be enough for me to say that the heavy Scarpas shoe, and other formidable engines, devised by the instrument makers, do, in my opinion, quite as much harm as good. They are too heavy for the already weakened limbs, and impose new and vicious attitudes upon the joints; the gaiter and straps, devised by Duchenne, with cords to represent the lost muscles, and spiral springs, to in some sort imitate their action, are much better, but these have their drawbacks.

{ - The gaiter compresses the limb and restrains the free action, of the muscles which still remain healthy, and the confinement prevents the will, from bringing into action those muscles, which are only slightly affected. For it must be remembered, that the

stimulus of the will, is the best and most effectual means of restoring a partially paralyzed muscle, to its former strength, and therefore it is that all these forms of apparatus should be avoided, until the third stage is reached, and we have attained a definitive limit, and that even then, any apparatus we may use, should be so devised, as not to restrain, the free action of the muscles, which are only weakened.

A mode devised by Mr. Barwell, of strapping a tin splint upon the outside of the limb, with adhesive plaster, and using cords, and indian-rubber springs, to represent the lost muscles, has at first sight, a very likely, and attractive appearance, but in actual practice I have found it to be very unsatisfactory, from the length of time which the dressing requires, and its temporary character when completed; and moreover, it sins against the canon I have just laid down, by compressing the muscles and so interfering with the action, and consequent growth, and nutrition, of those which are weakened.

The most promising plan, which I have as yet found, consists of a piece of clock spring, forming an outside splint, and strapped round the leg at the upper and lower ends, with straps containing a piece of watch spring well padded, which holds its position without pressing upon the muscles, and to this splint, I attach two small indian-rubber rings, from each of which a piece of silk wrapped with wire, (used by fishermen, and called gimp,) passes downwards. On the foot, a soft sock of chamois leather, made firm by a piece of watch spring round the heel, and fixed firmly by a piece of strong tape, (such as shoe-makers use for the tags by which we pull our boots on) which passes, from the extremity of the piece of watch spring, round the heads of the metatarsal bones, and is fixed to a button, or by a buckle on the outer side of the foot. The tape carries two or three, of the small rings, which are used on fishing rods for the line to work through, and to these the extremities of the two pieces of gimp are attached in such a way as to represent the attachment of the peronei and the extensor longus digitorum muscles.

The whole apparatus only weighs a trifle, and is easily applied and removed ; and in a case in which I applied it lately, it has acted very satisfactorily.

The subcutaneous injection of strychnia has been advised by Barwell, and seems in his hands to have given good results. I cannot say, that it has produced any marked effects in my hands, but, it may well be tried, especially in the cases, where the muscle, has ceased to respond to either form of electricity, but has not yet commenced to atrophy; one-fiftieth to one-sixteenth of a grain may be injected at once, according to the age.

Seguin also suggests, that anæsthesia should be induced, during the electrical explorations and treatment, not merely, in order to save the child pain, but also, in order that you may more readily recognize a small muscular contraction, and so not give too unfavourable a prognosis. He suggests the nitrous oxide as the best anæsthetic for this purpose, a suggestion which I scarcely like to support.

CASES OF INFANTILE REGRESSIVE PARALYSIS.

Case 1—*Name*, Eveline Kelly. *Age at attack*, 9 months. *Previous History*, Only child of young parents, apparently healthy; *Month of attack*, unknown; *History of attack*, fever causing some slight convulsive movements in night, and next morning found paralyzed. *Age when first seen*, three years. *Condition when first seen*, paralysis of both lower limbs, and atrophy. *Result*, unknown.

Case 2—*Name*, Fanny Bostock. *Age at attack*, seven months. *Previous history*, One of three children, both of the other children being quite healthy parents healthy. *History of attack*, child complained of pain and was restless at night, and next morning right leg was useless. *Age when first seen*, sixteen months. *Condition when first seen*, paralysis and atrophy of muscles of right leg. *Result*, unknown.

Case 3—*Name*, Mary Kirke. *Age at attack*, six months. *Previous history*, father killed by accident: was a healthy man. Mother quite healthy. Child was a fine healthy baby, finest of three, mother says. *Month of attack*, August. *History of attack*, Mother was carrying the child one very hot day, and she had been out in the sun some time, when the child suddenly screamed, and seemed to have a pain in the head, which rolled from side to side, and she found that it had lost the use of both legs; she took it to a druggist, who has treated it up to the present time. *Age when first seen*, eight months. *Condition when first seen*, paralysis of left leg, and partial of right, atrophy of left, not perceptible in right; response to galvanic, not to faradic current. *Result*, unknown.

Case 4—*Name*, Henry Trotter. *Age at attack*, unknown. *Previous history*, one of twins; the other is a strong healthy girl. *Month of attack*, August. *History of attack*, Mother can give no history, except that the legs gradually

became weaker, and says that the child always crossed his legs. *Age when first seen*, six years. *Condition when first seen*, paralysis of both legs, with atrophy of most muscles of leg and thigh, and much deformity. *Result*, unknown.

Case 5—*Name*, Henry Bancroft. *Age at attack*, one year and ten months, *Previous history*, One of a large family of healthy children ; parents both strong and robust. *Month of attack*, September, *History of attack*, Mother was confined, and on the birth of the child, the noise awoke the patient, who was asleep in the same room, he started up frightened, and began to vomit, had a convulsion, and these recurred from 5 a.m. till 3 p.m., when he fell asleep, and on awakening was found to be paralyzed ; this was ten days ago. *Age when first seen*, one year, ten months. *Condition when first seen*, the child was paralyzed in left arm and leg, and right side of face. The face and arm have quite recovered. The leg is still paralyzed. No loss of sensibility in skin. No contractions. The muscles respond to faradisation. *Result*, recovery.

Case 6—*Name*, Robert Peele. *Age at attack*, one year, six months. *Previous history*, strong healthy child. *Month of attack*, July. *History of attack*, could just get along by the chairs, when (without having noticed any illness previously), his mother found on placing him one morning, to the chair as usual, that he fell, and when put on to his feet, fell again. She then examined him and found that the left leg hung powerless, and the foot was "as cold as death." She warmed it before the fire, and with flannels, and tickled the sole to make him move his foot, but he took no notice. She wrapped the leg in flannel and thought that it would come round, but finding that it did not, she brought it to the dispensary a week afterwards. *Age when first seen*, one year, six months. *Condition when first seen*, the extensor of toes tibialis anticus, and peronei muscles were all paralyzed, and responded very feebly to the faradic current. The heel was raised, the toes pointed, and the leg swung round in a circle, the toes touching the ground first ; showing that it was moved only by the muscles of the thigh. After three weeks faradisation, he could move his toes, and on June 30th, 1873, nearly twelve months after his admission, he was discharged cured, there being no difficulty in movement, and

the parents leaving Manchester, were instructed to purchase a battery, and continue the electricity for a few months. *Result*, recovery.

Case 7—*Name*, Matthew Hand. *Age at attack*, one year. *Previous history*, Child was quite healthy until twelve months old, when it had an attack of scarlatina. *Month of attack*, August. *History of attack*, during the attack of scarlatina he had several convulsions, and was at the time cutting his eye teeth (during first week of scarlatina). When he recovered sufficiently to walk, it was noticed that the right leg dragged, and after some weeks it was noticed to be cold, and seemed smaller than the left, and that it was sometimes blue, especially at night, and in the day when he is sleeping. *Age when first seen* one year, eight months. *Condition when first seen*, the right leg paralyzed. Measures round calf, one inch below lower border of patella, five and a-half inches; left or sound leg in same place, six inches. The Extensor Communis digitorum, tibialis anticus, and peroneus tertius are paralyzed. Child is well nourished, and otherwise healthy. The paralyzed muscles answer but feebly to the induced current. *Result*, unknown.

Case 8—*Name*, Frederick Baxter. *Age at attack*, three years, six months. *Previous history*, was a strong healthy boy. Parents healthy. Never had fits or any other illness. *Month of attack*, March. *History of attack*, about four months ago, mother noticed that the child dragged the left leg after the other, and on examination it was found to be paralyzed. *Age when first seen*, four years. *Condition when first seen*, left leg measures across calf, two inches below patella, eight inches; right at same place measures $8\frac{1}{2}$ inches; left leg by Hawksley's surface thermometer shews $\frac{2}{3}$ of a degree lower temperature than right, and there is paralysis of the anterior and outer muscles of left leg, but all act well and quickly to the induced current. *Result*, improvement.

Case 6—*Name*, Lucy Chadwick. *Age at attack*, nine months. *Previous history*, A well nourished child, and mother says that she never had any illness until she began to cut her teeth, since which time she has been very ill every time that she has cut a tooth. At nine months old she could walk very well by chairs. *Month of attack*, February. *History of attack*, she was taken ill with what the mother calls tooth fever; was six weeks ill, and in the early part

of the time was in great danger. It began with convulsions, which continued about a fortnight, during most of which time she was insensible. During this illness the child was much purged and cut four teeth. It was during the first fortnight of the illness that the paralysis was noticed. The left arm and both legs were found to be paralyzed. *Age when first seen*, fifteen months. *Condition when first seen*, Since this time a gradual improvement has taken place, and there is now no trace of the paralysis of the arm, and very little in the left leg, but the condition of the right leg is very characteristic. The Tibialis Anticus and the Extensor Communis Digitorum give only the faintest tremor to long continued faradisation, but act pretty well with continuous current.

Case 10—*Name*, Marie Duffy. *Age at attack*, eleven months. *Previous history*, Fairly nourished child of seemingly healthy parents, youngest of two. Two or three weeks ago, had a violent attack of purging and vomiting, but seemed to get quite well in a day or two. A week ago, there was noticed, a slight twitching of the left eyelid, and also of left arm, but no convulsions followed. There was however a severe attack of hiccough. *Month of attack*, October. *History of attack*, soon after the hiccough had left her, it was noticed that she had lost the power of the right arm and leg, and side of face. *Age when first seen*, eleven months. *Condition when first seen*, the muscles respond to faradisation and the paralysis was gradually disappearing when she was lost sight of, and not seen again till ten months later when there was definitive paralysis and atrophy of right arm and leg. *Result*, Improvement.

Case 11—*Name*, Albert Dene. *Age at attack*, eleven months. *Previous History*, a strong healthy child at birth, suckled until five months old, when he refused the breast, and was weaned and reared with the bottle. Soon after this, he had attacks of pain, with loud cries, turning in of the thumb, clenching of hands and drawing up of legs, and face would become blue, and toes and finger nails, livid; and this condition would continue for three or four hours at once. There is no appearance of teeth, nor are the gums turgid or full. *Month of attack*, November. *History of attack*. This state of things continued until eight days ago, when, after a very bad attack of the kind related, he, (as usual after such attacks), fell asleep for about an hour; and when he woke, his mother

noticed that his left eye was drawn outwards (squint). This lasted two or three days, then passed off. The next day the mother noticed that the child did not suck its fingers, as it had been in the habit of doing ; and upon further examination the arm was found to hang useless against the side. She did not notice the condition of the leg until it was pointed out to her at the dispensary. *Condition when first seen*, The child was very thin and wasted, abdomen swollen and tympanitic ; stools often green, indeed showing all symptoms of atrophy from want of suitable food. The right side of the face, right arm and leg are all paralyzed. There is Ptosis of right eyelid, but no squint. There is complete paralysis of deltoid, and generally of right forearm, also of right thigh and leg. The paralysed muscles of arm and thigh respond feebly ; the deltoid irregularly, some fibres acting, others not, and the same may be said of the Supra and Infra Spinatus muscles under the induced current. The muscles of forearm and leg do not respond to faradisation, but pretty well to continuous current.

Five months later. All muscles respond to faradaic current. The sound leg is only $\frac{1}{8}$ inch greater in circumference than the paralysed one. Circumference of arm over deltoid. Right $5\frac{1}{2}$ inches ; Left $5\frac{3}{4}$ inches. The child can now lift its arm.

Case 12—Name, Anne Smith. Age at attack, one year nine months. *Previous History*, Child had convulsions when three months old ; bronchitis at seven months old ; measles at sixteen months ; had purulent discharge from right ear which has now ceased. *Month of attack*, July. *History of attack*. In July, twelve months before she was brought under observation, her father died from typhoid fever. During his illness he was attended at his own cottage, and his wife nursed him, with great devotion. On the day of his death, in the disturbance and agitation of the time the child was not watched, and wandered away from the open door of the cottage, and was lost. The day was a cold and wet one, and for a considerable time the child must have been exposed to the weather. She was found at last at the Police Station, sitting in her wet clothes before a fire. She was taken home and put to bed apparently quite well, but tired. It is believed that she slept well, but in the morning, it was found, that the right arm and leg were helpless,

and the mouth was drawn to the right side. At the time the child could talk pretty well, but from this she completely lost the power of speech. *Age when first seen*, two years nine months. *Condition when first seen*, The arm recovered gradually, the facial distortion disappeared, and the speech became sufficiently intelligible to be made out ; but the condition of the leg was but little improved. The paralysed muscles respond, to neither the induced nor the continuous current ; and in spite of a careful and continued treatment the condition when last seen (April 19, 1875), after more than two years treatment, was but little ameliorated, and she could only walk with a crutch, and the general health was not good. There was atrophy of muscles of leg and thigh with Equino Varus and Pes Cavus, the limbs cold and discoloured. and skin stocking-marked. *Result*, very little improvement.

Case 13—*Name*, Annie Briggs. *Age at attack*, eleven months. *Previous history*, a healthy child, one of a large family, all living and doing well. Parents strong and robust. *Month of attack*, May. *History of attack*, On the evening of May 9th, 1875 (a bright sunny day), the child was put to bed apparently well ; was cross and fretful in the night ; and when taken up next morning, the right leg was found to be paralysed, the muscles affected being the anterior and external group. *Condition when first seen*, The anterior and external muscles of right leg are paralysed, Electro-muscular contractility is reduced, but not lost to the induced current. The paralysis rapidly disappeared, lingering longest in the anterior muscles (Extensor Comm. Digit., &c.,) and in three weeks was entirely gone. Child walks now (1877) without slightest limp or any trace of the affection. *Result*, recovery.

Case 14—*Name*, John Partington. *Age at attack*, two years, eleven months, *Previous history*, Strong healthy boy ; suffered a good deal during dentition, but never had a fit ; one of seven, all living, only one of whom had a fit. One died from scarlatina, aged 3 years. The patient had whooping cough about twelve months ago. *Month of attack*, March. *History of attack*, The child complained of cold on March 27th, 1874, shivered and was thirsty, and complained of pain in the legs. He was put to bed, and when taken up in the morning, it was found that he could not use his legs, and complained of his feet being sore. *Age*

when first seen, two years, eleven months. *Condition when first seen*, On the 29th of March, both legs were found to be paralyzed, but the right was recovering. Pulse, 100. Temperature Popliteal space, 98; in axilla, 100-one-fifth. Respiration, 20. He was never seen again. *Result*, unknown.

Case 15—*Name*, James Evans. *Age at attack*, nine months. *Previous History*, Was a strong healthy child till nine months old, when he cut six teeth in one week, (two upper incisors, and four lower ones). *History of attack*, At the time of teething he had a fit, followed by an attack of bronchitis; and during this illness, the mother discovered that he had lost the use of his right arm. He was taken to a noted bone setter and treated for a sprain, and by a surgeon for fracture, and after a loss of about eighteen months, was brought to the dispensary, where he came under my notice. *Age when first seen*, two years, three months. *Condition when first seen*, His condition was that of a strong, well-nourished child, apparently in robust health. Every limb strong and well developed, except the right shoulder, which had lost its roundness, and the deltoid seemed to be almost absent. The Supra and Infra Spinatus muscles are also much atrophied, so that the round head of the humerus is visible together with the prominences of the acromion and coracoid processes; and the edge of the Glenoid cavity is clearly traceable. Right arm measures close to fold of axilla, $4\frac{3}{4}$ inches; left, $5\frac{3}{4}$ inches. From centre of sternum over right shoulder to spine of second dorsal vertebra, $8\frac{3}{4}$ inches, all round at same points $19\frac{1}{4}$ inches. *Result*, unknown.

Case 16—*Name*, — Domey. *Age at attack*, eleven months. *Previous history*, A stout, flabby child, but mother says has always been healthy until about eleven months old. *Month of attack*, July. *History of attack*, On putting the child down to walk one morning, the mother found that the left arm hung powerless by her side. She had not previously noticed any feverishness or restlessness, or illness of any kind. The child had been apparently quite well up to the very time she discovered the paralysis. It has been under various treatment, but no improvement has taken place that the mother can perceive. *Age when first seen*, two years four months. *Condition when first seen*, Evident paralysis of deltoid, and Supra and Infra Spinatus muscles. The arms measure over belly of

deltoid holding the tape as close as possible to the lower border of the boundaries of the axilla, on the paralysed (left) side 6 inches, on the sound one, $6\frac{3}{4}$ inches. The roundness of the shoulder is lost, and the bony prominences are distinct, and no muscular structure can be recognized. The Latissimus Dorsi and the Teres muscles are wasted, and the hand hangs with palm outwards, and thumb backwards. No reaction of deltoid to either current, but only some fibrillary tremblings, and these only when over 20 cells of Foveaux's battery is used. The Pectoralis and the Latissimus Dorsi respond pretty well to the continuous current. *Result*, unknown.

Case 17—*Name*, William B—. *Age at attack*, five months. *Previous history*, A strong healthy boy, the finest of a family of four. Father's family has a Phthisical history; mother, healthy, labours natural and easy. *History of attack*, Was quite well until five months old, when the family went to Lytham in the first week of October. The weather was sultry, but cold towards evening. It rained that evening. A perambulator was hired, and he was taken out by nurse the same evening. Next morning he was fretful and feverish, and had passed a bad night, a very unusual thing for him. This continued all day. I did not see him again for a day or two, when his mother called my attention, to his curious position as he sat on her knee. And I found him totally paralysed on the right side, and there was also facial paralysis, and the head fell on to his shoulder. *Age when first seen*, five months. *Condition when first seen*, This state of things continued with slight improvement; and at the age of one year, three months, the state was as follows:—Head leaning slightly to the left. Could not walk when held by mother; throwing the right leg out from the hip; so that the foot traverses a segment of a circle and crosses the sound one, the toe touching the ground first. The arm has recovered itself entirely, but neither the Tibial muscles nor the Ext. Comm. Digit. respond to induced current; but with 50 cells of Foveaux's Continuous Battery there is some very slight movement of Tibialis Anticus, but none perceptible of the Ext. Comm. Digit. or Peroneus Tertius. Circumference of sound leg, 2 inches below lower border of Patella, $6\frac{5}{8}$ inches of paralysed leg 6-3-sixteenth inches.

June, 1877, aged 5 years. There are now no traces of the paralysis anywhere, except in the right leg, which measures $\frac{1}{8}$ of an inch shorter than the sound one, the Ext. Com. Digit. and the Peroneus Tertius are still paralyzed in spite of continued treatment by both currents. There is slight Pes Cavus, but the boy can walk, run, and jump, and active measures have been discontinued, in the hope that the activity natural to his age will serve to preserve all such muscles as are not hopelessly atrophied. *Result*, much improved.

Case 18—Name, Harry Sykes. Age at attack, two years. Previous history, A strong healthy child, the only one his parents have had; they are both healthy and strong. When six months old, the child had "croup," and was ill about a month. At the time of cutting his teeth was feverish with each one, but never had a fit; has had bronchitis. Could walk well at eleven months. *Month of attack, September. History of attack,* Mother noticed nothing till about six months ago, when she thought that he turned his toes in, and walked "twine-toed." She used friction and salt, and finding that he got no better, she finally brought him to me. *Age when first seen, two years, six months. Condition when first seen,* Paralysis of Ext. Comm. Digitorum and Peronei of both legs, the feet present the blueness of colour, and show the stocking markings, and the muscles respond to 50 cells of Foveaux's Continuous Current Battery. After four months the muscles respond to induced current. (Still under treatment). *Result*, much improved.

Case 19—Name, George Todd. Age at attack, six weeks. Month of attack, July. History of attack, In the month of July, when the child was six weeks old, the mother noticed, (without having seen any previous illness) that the child never attempted to use its right hand and foot, which hung perfectly useless, the palm of the hand turned outwards, and the thumb backwards, the foot turned inwards and the toes pointed. No treatment except cold bathing seems to have been adopted, and after a lapse of more than 2 months, the foot and leg recovered, but the arm still remains paralysed. *Age when first seen, 1½ years. Condition when first seen,* The right arm is quite paralysed, the palm turned outwards. He can raise his hand to the mouth by an effort. The muscles answers to 30

cells of Foveaux's Continuous Current, particularly when the poles are reversed after about 30 seconds. *Result*, unknown.

Case 20—*Name*, Elizabeth Ogden. *Age at attack*, nine months. *Previous history*, This child was perfectly healthy, and could stand and pull herself up by the chairs. Never had any fit. *Month of attack*, December. *History of attack*, A week ago the mother found the child to be hot and feverish and restless at night. On the following morning, mother found that the left arm and leg were powerless, and child could no longer pull itself up by the chairs. *Age when first seen*, nine months. *Condition when first seen*, The face is slightly drawn towards the left, paralysis of right side. The Deltoid, Supra and Infra Spinatus muscles of left side of body, are paralysed and do not respond to Faradaic current. Biceps on same side responds but feebly. The left foot hangs. The Tibial Muscles and Extensor Communis Digitorum respond feebly to faradisation. To the continuous current the Deltoid and Supra Spinatus respond well, as also the Extensor Communis Digitorum.

On January 29th, 1874, all muscles respond well to induced current ; there is no perceptible reduction of temperature or lividity of colour. The child was then lost sight of, until the end of April, when the condition of the leg was found good, but the Deltoid and Supra Spinatus muscles had very much retrograded.

December 28th, 1874. The child can walk by chairs ; but there is wasting of Deltoid, though that is improving. *Result*, much improved.

Case 21—*Name*, Mary Ross. *Age at attack*, fourteen months. *Previous history*, Child was quite well till fourteen months old, when she was teething, but never had any fit. *Month of attack*, August. *History of attack*, Whilst teething, the mother noticed that when the child was put down, she did not use the left leg. At first she thought that this was only debility, but as she did not improve, she was taken to a public institution, where a Scarpa's shoe was ordered. *Age when first seen*, three and a half years. *Condition when first seen*, The condition at the present time is that the left (paralysed) leg is $\frac{3}{4}$ of an inch shorter than the right, the foot falls but is not inverted (the effect of shoe). Measures round calf, 1 inch below patella ; on paralysed side, $6\frac{5}{8}$ inches ; on

sound side, $7\frac{3}{4}$ inches. No response to 30 cells of continuous current. Slight response when applied by Remak's mode to nerve. *Result*, unknown.

Case 22—*Name*, Andrew Johnson. *Age at attack*, ten months. *Previous history*, Child was quite healthy ; is one of nine children, seven of whom are now living, and in good health. Parents healthy. The two children who are dead, died from scarlatina. *Month of attack*, March. *History of attack*, Without previous illness having being noticed, the mother found one morning when she took the child up, that the face was drawn towards the left and that the left arm and leg were powerless. *Age when first seen*, one year. *Condition when first seen*, The arm was still powerless, but the leg has almost recovered ; both respond to the faradaic current. When the child was lost sight of, he had, apparently, recovered, but his mother neglected to forward her address and left the town. No loss of sensibility ; no contractions. *Result*, probably recovery.

Case 23—*Name*, Sarah Sharpe. *Age at attack*, five months. *Previous history*, Child has always been perfectly well ; and the day being warm, was out all day in the charge of a little nurse girl, and at night was put to bed apparently quite well. *Month of attack*, July. *History of attack*, It was restless and cried during the night, but mother did not notice any sickness, or appearance of fits, but when she took it up in the morning, the right leg was found to be useless. Cold sponging was used, and gradually the child became able to walk, but it always dragged the leg, and gradually the present deformity became noticeable. *Age when first seen*, seven years. *Condition when first seen*, The right thigh is 1 inch less in circumference than the left. The heel of right foot is $1\frac{1}{2}$ inch higher than the sound one, but the inner angles are almost level. Round calf, 2 inches below lower border of the patella ; right leg measures $6\frac{3}{4}$ inches ; left (sound) leg, $8\frac{1}{2}$ inches. The foot is in Pes Cavus. Tenotomy. *Result*, some improvement.

Case 24—*Name*, Frances Wright. *Age at attack*, four years. *Previous history*, Was a strong healthy child, walked early, and could run well. At three months old had a severe attack of diarrhoea, lasting from ten to twelve weeks (Enteric Fever?). After this got rapidly well and walked at ten months.

Had two teeth at birth, cut rest early, and never had a day's illness, from the time of the attack above mentioned, till almost four years old. *Month of attack*, May. *History of attack*, One day in May, 1868, she came home from school, and played all the evening as usual, and went to bed seemingly all right and well. In the morning her parents called her, but she did not answer, and the mother going to see what was the matter, the child looked up and said, "I can't walk," and did not speak afterwards for two hours, being in convulsions. These ceased, and then the parents noticed that the arm and leg were quite useless, but there was no deformity in the face. The arm has quite recovered, but the leg has continued powerless. The child has been away with a relation in Yorkshire for the last year or two, and on its return the deformity was so much greater, that the parents brought her to the children's dispensary. *Age when first seen*, nine years. *Condition when first seen*, The arm has quite recovered itself, and the measurements round the sound biceps are alike in both arms. The right or paralysed leg is $\frac{1}{4}$ inch shorter than the left, measured from top of trochanter Major, to lower edge of outer ankle. Circumference of right thigh is 1 inch less than left at same points. The circumference of calf is less also by same amount. *Pes Cavus* well marked. Tenotomy performed. *Result*, some, but slight improvement.

Case 25—*Name*, Clara Fletcher. *Age at attack*, one year. *Previous history*, Is the first child of apparently healthy parents, and was quite well until twelve months old, when she had several convulsions; previously to these she could stand by the chairs, and walk a little. *Month of attack*, December. *Previous history*, When she recovered from the convulsions, her mother found that she could not stand. *Age when first seen*, fifteen months. *Condition when first seen*, There is paralysis of anterior and external muscles of both legs with consequent varus, but slight, and muscles act to faradaic current. *Result*, recovery.

Case 26—*Name*, Alexander Male. *Age at attack*, four months. *Previous history*, Was a forward child, and spoke well at eleven months, quite strong and healthy, and never had any sickness of any kind till his present illness. *Month of attack*, August. *History of attack*, When four months old in the month

of August, 1868, the parents moved from Manchester to Sheffield, the weather was hot and sultry, and the mother was much fatigued, and in consequence the child was a good deal exposed. A day or two after the removal he was feverish and relaxed in his bowels. This went on for 1 or 2 days before medical assistance was obtained. He was restless and moaned at night, but mother did not notice any contractions of fingers or toes. He was attended by a medical man for about a fortnight, when he was considered better, neither the surgeon nor the mother, noticing at this time anything wrong with the legs; and it was not until two or three days afterwards that his mother noticed that he did not walk about as he had been accustomed to do, and upon examination found that his legs hung useless from the hip down. She did not at this time notice any affection of the arm, though she has since noticed that one arm is smaller than the other. Electro magnetic battery was used to spine, not to legs. Friction, &c., were applied, and there was a slight but very gradual improvement. At this time he was left handed, but has now been "broken of that habit," as his mother says. *Age when first seen*, six years. *Condition when first seen*, The patient is a bright intelligent lad, whose appearance at once arouses one's sympathy. He is a cripple from the hip downwards. The Extensor and Adductor Muscles of the thigh on both sides are quite paralysed, and there is flexion of the knees, and turning outwards, and progress is made by the action of the abductors throwing the leg outwards. The muscles of the Anterior, Posterior and External groups of the left leg are paralysed, and to 14 cells of Stöhrer's Continuous Current Battery, give only feeble tremulations on reversing the poles; but by a quick change, the effect is slightly increased. Sensation is undiminished, a single cell being felt, and dreaded by the boy. The right leg is paralysed as to the Anterior and External muscles only; there is, consequently, varus on this side, when the foot is thrown forwards in attempting to walk. The bones of the thigh and leg are visible in all their contour, scarcely clothed with more than a drapery of skin. The Rectus Femoris and Extensor Proprius Pollicis seem to be almost the only muscles left, and when they are made to contract, they stand out like cords under the skin. On the left side, even this small amount of muscular activity does not exist.

This case, hopeless as it is, improved considerably whilst the mother brought him regularly to the dispensary, but it was lost again during the boy's absence from attendance. *Result*, little or no improvement.

Case 27—*Name*, John Pope. *Age at attack*, nine months. *Previous history*, Always a weakly child from birth. Was vaccinated at the usual time, and now has three tolerably good marks. Had an attack of smallpox at nine months (the disease was in the house), but had a very few pustules. He was ill, feverish, and restless for about ten days, but had no fits or any other illness. *Month of attack*, June. *History of attack*, After his attack of smallpox, he seemed to get well, but his mother found that his legs and feet were useless. It was the fact that he never kicked that first drew her attention to this. When two years old, he seemed to make some attempt to move his feet, but it was not until the present year that he could hold his body upright by the aid of chairs. *Age when first seen*, three years. *Condition when first seen*, There is much wasting of the legs and tendency to varus. The Gastrocnemii are firm to the touch. There is paralysis of the muscles of the external and anterior region of the legs, and consequent pointing of the feet and dragging of the toes. Thighs are a little if at all affected. The child is in good health, but cannot talk well. The muscles do not respond to the Faradaic current, and but feebly to 8 cells of Stöhrer's continuous current battery. The temperature of the feet is lowered, the surface is livid, and the feet are stocking marked. Temperature of right leg, 87° F.; exposure, 20 minutes. After three months, the muscles respond well to the induced current, and the child walks with slight varus. In June, 1875, after twelve months treatment, the muscles respond well to faradisation, not at all to the constant current. The child walks well, and there is a very slight tendency towards varus. *Result*, probably recovery.

Case 28—*Name*, Edward Hyde. *Age at attack*, sixteen months. *Previous history*, This child was quite well and had cut ten teeth. He could walk very well up to a day or two before I first saw him, at which time he cut the right upper canine tooth. *Month of attack*, July. *History of attack*, The same night his mother noticed that he was very cross and tedious, and upon putting him down to his feet next morning, she found that he could neither stand nor move

the right leg ; since then the right leg has recovered, but he has lost the use of the left leg. The loss of motion in this leg was only noticed on Saturday. I saw him on the Monday. *Age when first seen*, sixteen months. *Condition when first seen*, There is evident paralysis of the left leg, the muscles of anterior and external surfaces. The child has cut another tooth (lower molar). The reaction to faradaic current was already lost, but there was slight but distinct reaction to 12 cells of Stöhrer's constant battery. When last seen, the improvement was marked, but paralysis still existed. *Result*, improved.

Case 29—Name, John Kearsley. *Age at attack*, sixteen months. *Previous history*, Was quite well until three days ago, when the child cried a good deal in the night, and the mother found in the morning that he had cut the left eye tooth. *Month of attack*, July. *History of attack*, Upon taking him out of the cradle in the morning, it was found that the right arm and the left side of the face were paralysed. *Age when first seen*, sixteen months. *Condition when first seen*, The paralysed muscles all act well under the stimulus of the induced current. A month later, he was quite well. *Result*, recovery.

Case 30—Name, Martha Horrocks. *Age at attack*, one year, nine months. *Previous history*, Child was but weakly, being born after hard labour, and mother was ill when suckling. When ten months old, the child was seized with convulsions (which recurred during about two months), but eventually recovered without any apparent permanent results being left, and so continued for about nine months, when at Whitsuntide she was once more seized with convulsions. *Month of attack*, May. *History of attack*, On her recovery from the convulsions, the mother found that the child had lost the use of the left arm and leg and right side of face. Since this time she has recovered a considerable degree of motion of the leg, but the arm is still paralysed. *Age when first seen*, two years. *Condition when first seen*, Child squints, and can only say "mamma." On the paralysed side the Deltoid and the Supra and Infra Spinatus muscles are atrophied, and act feebly to 8 cells of Stöhrer's Continuous Current Battery, and not at all to faradisation. The muscles of the leg and thigh on same side respond to the induced current. The leg and thigh improved considerably, but

Pneumonia set in ; and, parents living at a distance, the child was lost sight of.
Result, some improvement.

Case 31—*Name*, Mary Deakin. *Previous history*, The mother is dead, and the child is in charge of a relation, who knows little or nothing of its early history. *History of attack*, The child seemed quite healthy, and nothing was noticed till it began to walk, when the right leg was seen to drag, and the child fell from the toes catching on the ground. She had convulsions when teething. *Age when first seen*, four and a half years. *Condition when first seen*, There is equino varus of right leg, and shortening to the extent of $\frac{1}{4}$ of an inch. The Tibialis Anticus acts feebly to faradisation. The knee turns inwards, and the muscles of the front and inside of the thigh, act but feebly to the induced current. *Result*, unknown.

Case 32—*Name*, Edward Lowe. *Age at attack*, four months. *Previous history*, One of a family of four, of whom one died, aged four months, from obstruction of the bowels. All the rest are healthy. Father and mother quite strong and healthy. Was quite well till four months old, when one morning mother put him into his cradle, apparently in perfect health, smiling and crowing. He had the same morning on rising, almost stood alone in his bath, whilst being washed, with only his mother's arm to cling to, and "kicked his legs about as though he would walk if he could." *Month of attack*, October. *History of attack*, It was about eleven o'clock in the morning when he was put into his cradle, and he slept until two in the afternoon. The cradle was in the same room as the mother the whole time, and she was not away from it for more than a minute, at any one time. She was sewing ; she did notice any restlessness or movement until he woke, when she took him up, although he did not cry. She found him quite helpless in her arms, and his head fell upon one shoulder or the other according to the way in which he was held. He moaned feebly and could not suck the breast, so that he had to be fed with a spoon, for he could not suck the bottle. His cry was very low and feeble, and the head was "smoked like a fire." When the child cried his mother noticed that the face was drawn towards the left side. He never had any fits. He was paralysed in all four limbs. *Age when first seen*, two years eight months. *Condition*, The child

has been under treatment for about three months. It is now recovering the use of its arms, and can sustain the head upon the trunk. The right leg is also beginning to recover somewhat. There is no perceptible difference in the length of the two legs, but the toes of the left point downwards. At the first glance that leg seems the longer. The thigh measures close to Perinæum (left) 8 inches; right, $8\frac{1}{2}$ inches; calf (left), $5\frac{1}{2}$ inches; right, $5\frac{1}{8}$ inches. The arms are now quite normal in form and action. The muscles of front and Exterior of leg do not respond to 14 cells of Stöhrer's Continuous Current Battery, but there is a little fibrillary trembling on changing the poles. No response whatever to faradisation. *Result*, unknown.

Case 33—*Name*, Mathew Stringer. *Previous history*, Mother seems a dull unintelligent woman, and no clear account can be obtained from her. She says that she never noticed the child having any illness. *History of attack*, She did not notice anything, but that it did not attempt to walk till nineteen months old, then she noticed that he dragged the left foot. About a month ago the child was sick and restless for about twelve days, but had no fits, and there has been no increase of paralysis or any other symptom since. *Age when first seen*, two years. *Condition when first seen*, There is paralysis of the left leg with slight outward turning of the foot. All muscles react to faradisation, except the Tibialis Anticus, which responds very feebly, if at all. The left leg measures over the calf $5\frac{3}{4}$ inches; the right $6\frac{1}{2}$ inches. The patient attended very irregularly, and was eventually lost sight of. *Result*, unknown.

Case 34—*Name*, Joseph Kitchen. *Age at attack*, one year, six months. *Previous history*, Always been a healthy child; one of strong and robust parents. Had bronchitis at three months. *Month of attack*, June. *History of attack*, Six weeks before I saw him he could walk well, and was put to bed apparently in perfect health. Mother did not notice any restlessness or trouble during the night, but in the morning when she put him on his feet as usual, he fell, and she saw that he had no use in his legs. No paralysis of face or arms was noticed. *Age when first seen*, one year, eight months. *Condition when first seen*, The left leg is recovering. There is paralysis of Anterior and External muscles of right leg, and consequent Equino varus. Tibialis Anticus and

Extensor Communis Digitorum show no reaction to faradisation or the continuous current. After twelve months patient application, most of the muscles respond to the induced current. A Scarpa's shoe was applied, but proved to be too heavy, and the limb was then put up in Barwell's mode, which proved very tedious and troublesome. A new method was then tried with but partial results ; and in the end, the father, a mechanic, made a much lighter shoe than the one supplied by the instrument maker, which the child still wears. *Result*, some improvement.

Case 35—*Name*, George Donkerley. *Age at attack*, two years. *Previous history*, Youngest of three children, whose mother died of consumption three months ago. The other two are weakly, eldest is pigeon chested. The patient was weakly whilst suckling, but was weaned at seven months, and then grew stronger. Never had fits, but had measles last summer, and has recovered. Walked at twelve months pretty well. *Month of attack*, July. *History of attack*, Three weeks before he came under my notice, the mother noticed one morning that he did not seem well. In the morning he was cross and looked weary, but he ran about the house as usual. At noon, he sat at the table at dinner, but ate but little. After dinner, the father took him in his arms and set him on his feet, when he fell down ; the mother lifted him up, and put him once more on his feet, when he fell on his face. She took him up once more, and looking at his legs, found that they were quite powerless, but she did not at that time notice anything wrong with the arms. The day was wet and cold, and during the morning the child had been sitting upon the doorstep. It wore no napkin. During the rest of the day the child seemed to get worse. He vomited, and when his back was touched, or when lifted by the arms he screamed. All the next night he was rather feverish and vomiting, but had no fits. *Age when first seen*, two years. *Condition when first seen*, Paralysis of both legs, the left recovering rapidly ; but the Tibialis Anticus, Peronei and Ext. Comm. Digitorum of right leg are quite paralysed, and react but feebly to 12 cells of Stöhrer's Continuous Current Battery, not to induced current, and the child is very tender over spine in dorsal and lumbar regions. Child is very cross and fretful, and will not allow the weight of the body to come on to the spinal column, and draws

up his feet when put to stand. Urine normal and quite under control of will. Bowels irregular, but he is quite aware when he wishes to defecate. Some stiffness of Sacro-Spinal muscles, which I believe to be voluntary.

In October of same year. The left leg has recovered ; there is still paralysis of the right leg ; but child does not cry when raised by arm pits. He will now walk, but shrinks a little when the spine is tapped.

In April, 1875. The report is that the child is almost well. The muscles respond to the induced current, and the child walks well, and is going to Yorkshire. He was then lost sight of. *Result*, much improved.

Case 36—Name, Ellen Noon. *Age at attack*, three years. *Previous history*, Was always a healthy child, only illness was whooping cough when one year old. *Month of attack*, August. *History of attack*, About three weeks ago it was a wet day, and the mother did not let the child go out, but kept her playing on the flagged floor of the houseplace, the door being wide open. When she put her to bed that night, the child was feverish and thirsty, restless and tossing about ; and when her mother took her up in the morning, it was found that she could not stand. A day or two later, the mother found that the child could not grasp anything in her hands. *Age when first seen*, three years. *Condition when first seen*, The child is paralysed in both legs. The hands and arms have now recovered any power they may have lost at the time of the attack. The left leg is improving, and the muscles respond to faradisation ; the right only to the continuous current. Temperature of right leg, slightly lower than that of left. *Result*, Recovery.

Case 37—Name, Francis Mason. *Age at attack*, one year eight months. *Previous history*, The child had been healthy from birth ; never had fits or any other infantile trouble, until five weeks before I saw him. *Month of attack*, June. *History of attack*, On the night of the last Saturday in June, the mother took the child with her to market. It was late when she got home, and she thought when she put him to bed that his right arm hung useless ; and on the following Sunday morning she found him sick and purged, and he has not been well since. He was in bed a week. Nothing was noticed as to the legs. He is still suffering from diarrhoea. *Age when first seen*, 1 year 9 mos. *Condition when*

first seen, The child is feverish and relaxed. The Deltoid and Supra Spinatus muscles of the right side are paralysed, and respond to neither the induced nor the continuous current. Fourteen cells of Stöhrer's were used. He has cut his canine teeth recently. The feet are unaffected. *Result*, unknown.

Case 38—Name, Emma Pinks. *Previous history*, The child was always healthy until the present illness, for which she was brought (diarrhoea) mother says No history of any ailment can be traced in her family. *History of attack*, The child was admitted, suffering from diarrhoea, and on examination was found to be paralysed in the arm. Mother says that the child has not used it, for some weeks past, but she had evidently not noticed it till it was pointed out to her. *Age when first seen*, one year, eight months. *Condition when first seen*, The Deltoid and Spinatus muscles respond very slightly to faradisation. There is evident wasting of muscular substance and prominence of bony points of shoulder. *Result*, unknown.

Case 39—Name, Mary Ellen Rigby. *Age at attack*, one year, three months. *Previous history*, Only child, was quite healthy and strong till an attack of diarrhoea six weeks ago, from which it recovered, without any apparent sequelæ. *Month of attack*, August. *History of attack*, Three weeks before I saw the child the day being wet and thundery, it was playing about the house all day quite well, and the mother put it to bed without noticing anything wrong. But next morning the child was washed, dressed, and put down to walk as usual, when it fell, and the mother found upon examination that it could not use its left leg. No other defect was noticed. *Age when first seen*, one year, four months. *Condition when first seen*, The child is, the mother states, in much the same state as on the morning she first noticed that it could not walk. It is very sharp and looks intelligent, and talks well for its age. The muscles of the Anterior and External group are quite paralysed, but respond well to the induced current.

On December 3rd, the report is that the leg has quite recovered its power, and that the child walks well. *Result*, recovery.

Case 40—Name, John Furnish. *Age at attack*, one year, six months. *Previous history*, Is one of a family of eight, of whom four died from whooping cough

and chest disease. Mother is a strong healthy woman, and says that the father is also healthy. No history of any constitutional illness can be elicited. Child was quite well till a fortnight ago. *Month of attack*, September. *History of attack*, On September 26th, 1874, the mother noticed that the child, which had been playing about all the morning, was hot and feverish. She gave him a Calomel powder and put him into bed. He slept well that night, and in the morning seemed better; but during the Sunday he again became feverish and fretful, and about one p.m., seeming worse, she put him to bed, but he continued so ill that she had to nurse him, and did not put him to his feet until Monday, when she found that his right leg was useless and bent under him. Saturday and Sunday was very hot days. 76° F in the shade. *Age when first seen*, one year, six months. *Condition when first seen*, I saw him on the Thursday, a wet stormy day. I found that he was cutting his eye teeth. There was then some tenderness over the Sacro-Spinal muscles in the lumbar region. There was paralysis, apparently disappearing, of the internal muscles of right thigh and of Anterior and External region of right leg. All respond to faradisation. Can walk a step or two. Could not stand on Tuesday.

Six weeks later he could walk well. *Result*, recovery.

Case 41—*Name*, Sarah Smawley. *Age at attack*, eleven months. *Previous history*, Was a perfectly healthy child until the attack, and walked pretty well for her age. *Month of attack*, August. When eleven months old she was seized with a feverish attack, was hot and restless, and this illness lasted for about a fortnight, during which time she would scream when put down to walk, which she never would attempt afterwards. She recovered from the acute attack, but did not attempt to walk. *Age when first seen*, three years. *Condition when first seen*, There is paralysis and atrophy of right leg. Circumference of right leg is $6\frac{1}{2}$ inches; measured 1 inch below lower border of patella; of left or sound leg $7\frac{1}{2}$ inches. The Tibialis Anticus and the Extensor Communis Digitorum do not respond to induced or continuous current (14 cells). Temperature of paralysed leg is 82° F with Hawksley's surface thermometer. There is much pain in leg in cold weather, and the child will cry suddenly and say it hurts (cramps). *Result*, unknown.

Case 42—*Name*, Henry Priestly. *Age at attack*, six months. *Previous history*, Was a perfectly healthy child, and parents were both strong and robust with good family histories. The child could get along very well by the chairs. *Month of attack*, July. *History of attack*, One morning when the mother took the child out of his bed she found that he could not use his legs. No previous disturbance of health had been noticed ; nor was any other defect seen. He was treated with friction and salt water baths. *Age when first seen*, three years. *Condition when first seen*, There is definitive paralysis of both legs. The child can stand by chairs, but not without support. He does not attempt to walk unless supported under the arm pits ; and in these attempts the feet and legs are thrown out from the hip. Length of right leg from Anterior Superior Spinous process of Ilium to lower border of outer angle $14\frac{1}{8}$ inches ; of left 15 inches. Circumference of right thigh 10 inches ; left $9\frac{1}{2}$ inches. Circumference of right calf two inches below lower border of patella $6\frac{3}{4}$ inches ; left $6\frac{1}{4}$ inches. Temperature (Hawkesley's surface thermometer) right leg inner side of Tibia 81-2-fifths F. ; outer side 76 F. ; left leg inner side of Tibia $75\frac{1}{2}$ F. ; outer side 79 ; right thigh inner side 89-3-fifths F. ; outer side 86-3-fifths F. ; left thigh inner side 86-2-fifths F. ; outer side 86 F.

Six months later. All muscles respond to faradisation. *Result*, improving.

Case 43—*Name*, Charles Finch. *Age at attack*, eight months. *Previous history*, Is youngest of six, four of whom are living. The two who died were one (of eighteen months) from fits, the other (six weeks old) from whooping cough, which was in the house when he was born. The rest are remarkably fine children. This child was quite healthy till August last, 1874. *Month of attack*, August. *History of attack*, He was seized with an attack of diarrhoea, which lasted about a week, and left him very prostrate, and he lay quite useless. This continued for some days, and then he gradually recovered, but his left leg was left useless. No affection of the arms was noticed. *Age when first seen*, one year, five months. *Condition when first seen*, There is paralysis of the left leg, but all the muscles respond to faradisation, except the Tibialis Anticus, Peroneus Tertius, Extensor Longus Digitorum, but these respond to 10 cells of Stöhrer's Continuous Current Battery. Circumference of left thigh $7\frac{1}{8}$ inches ;

calf $5\frac{1}{8}$ inches ; circumference of right thigh $7\frac{7}{8}$ inches ; calf $5\frac{5}{8}$ inches. *Result*, unknown.

Case 44—*Name*, Marian Arthur. *Age at attack*, one year, eleven months. *Previous history*, The youngest of five ; all healthy ; never had fits, but all had measles. Nothing wrong was noticed till one day in August, 1874. The child was late in walking, and was very stout. *Month of attack*, August. *History of attack*, It was a hot Sunday, and the child had been playing about all day on the stone floor of the house, and was put to bed apparently well ; but next morning, after she had been dressed, the mother put her down to walk, when she fell. The mother picked her up and put her on her feet again, when she again fell and cried. Thinking she was cross, her mother put her hands under the child's arm pits, and tried to walk her across the floor, but saw that the left leg dragged, and that the child had no use in it. Nothing was noticed as to the other limbs. *Age when first seen*, two years, six months. *Condition when first seen*, Definitive paralysis of Anterior and External muscles of left leg, and consequent atrophy and varus. The left leg is $\frac{1}{8}$ of an inch shorter than the right. Circumference of thigh at groin (left) $10\frac{1}{2}$ inches ; right $11\frac{1}{4}$ inches. Circumference of calf, 2 inches below patella (left), $6\frac{5}{8}$ inches ; right $7\frac{1}{4}$ inches. There is but feeble reaction to 12 cells of Stöhrer's Continuous Current Battery. *Result*, unknown.

Case 45—*Name*, John Price. *Previous history*, Is an orphan, and person in charge can give no history, but says that he did walk when an infant. *History of attack*, Wanting. *Age when first seen*, twelve years. *Condition when first seen*, left leg 1 inch shorter than right, and all the muscles of the leg and thigh are atrophied.

Circumference of left calf 3 inches below lower border of patella $8\frac{1}{4}$ inches. Circumference of right calf 3 inches below lower border of patella 10 inches. Circumference of left thigh at fork $13\frac{1}{2}$ inches. Circumference of right thigh at fork $17\frac{1}{2}$ inches. Length of left arm from tip of shoulder to Styloid process of Ulna 16 inches ; length of right arm from tip of shoulder to Styloid process of Ulna $17\frac{1}{2}$ inches. Circumference of left arm, middle of biceps, $6\frac{1}{4}$ inches ; right $7\frac{1}{2}$ inches. No perceptible reaction to either current. *Result*, unknown.

Case 46—*Name*, Robert Byrom. *Age at attack*, two years. *Previous history*, Both parents dead, mother from cancer. Two other children are living and in good health. *Month of attack*, March. *History of attack*, The person in charge says that he was quite healthy till about three months ago, when he was seized with convulsions and lay unconscious for a week, and then gradually recovered, and upon recovery it was noticed that he used neither leg nor the right arm. Since then he has recovered the use of his right leg; and a week or two ago he began to use the right hand. Since then things have been stationary. *Age when first seen*, two years, three months. *Condition when first seen*, Paralysis of right leg and arm, also slight paralysis of left leg. All muscles respond to faradisation. *Result*, unknown.

Case 47—*Name*, Alexander Jones. *Age at attack*, one year. *Previous history*, Family history good; is one of five healthy and strong children. Never had any illness until the seizure. *Month of attack*, July. *History of attack*, When twelve months old, he had an attack of convulsions which lasted about an hour; and on his recovery it was found that the right arm and leg were paralysed. The arm recovered, and the leg improved considerably soon after; but the present condition is much the same, except the deformity. *Age when first seen*, eight years. *Condition when first seen*, There is definitive paralysis of right leg, with atrophy of muscles of both thigh and leg, and lowering of temperature. The skin of the foot is mottled and stocking marked. No response to either current. *Result*, unknown.

Case 48—*Name*, Minnie Halligan. *Age at attack*, one year, five months. *Previous history*, Father and mother healthy, four living children and one abortion (the first). She had sore nipples and consequently could never suckle any of her children, but they never had any marks or spots except the measles, which the whole family had in November last. Never snuffled. The child has been quite well ever since, and never had any fits. *Month of attack*, July. *History of attack*, About a month ago on a Saturday about the middle of July (a very hot day) the child seemed feverish and flushed and was restless during the night. This continued all Sunday, but it could toddle about the room, though not so well as usual. Mother noticed that she tottered. That night she seemed to sleep

better than on Saturday, but when taken up on Monday morning, it was noticed that she wanted to sit down instead of standing by the chairs as usual, and upon examination it was found that she could not walk. The hands were not affected but the head, slightly falling to the left. Since then the child has had an attack of diarrhoea, but for the rest continues the same. *Age when first seen*, one year, six months. *Condition when first seen*, Paralysis of both legs Anterior and Internal muscles of thigh and External and Anterior muscles of leg, all answer feebly to the induced current, and not at all to continuous. *One month later*, having been out of town, the application of the current has been left to Mr. Renshaw; and on my return I find that it has been intermitted in consequence of an attack of diarrhoea, and now the paralysis is localized in the left leg, which is cold and bluish in colour. The muscles of the front and outside of this leg no longer respond to faradisation. On the right side they respond actively. To the continuous current, however, they answer well. The ankle is not affected. There was a relapse of diarrhoea, and the state of the muscles retrograded. *Result*, unknown.

Case 49—Name, Edith Ridgway. *Age at attack*, one year, eleven months. *Previous history*, Is one of a family of two; the elder, a boy of eleven years, is quite healthy. Mother has had seven children, five of whom have died in infancy, the one that lived the longest was two years old and died from whooping cough. One miscarriage at $5\frac{1}{2}$ months in pregnancy. Father is a strong and healthy man. The child was strong and healthy, and walked well at eighteen months. Had whooping cough at three months. Never had convulsions. *Month of attack*, July. *History of attack*, A month ago, on the Monday, (washing day,) the child was running about the house all day, and at night was relaxed in her bowels. Mother put her to bed apparently quite well about 8 p.m., and at 10 p.m., she went up stairs as the child was crying. She took her up and found her hot, and she was restless all night, but nothing further was noticed. In the morning it was found that her nose was running and they thought that she was commencing with measles, but no rash came out. This state of things lasted for a week; and during this time nothing was noticed about the feet, as she lay in bed all the time. Afterwards her father noticed that she lay in bed

with her legs stretched out, and did not attempt to move them. They then put her to the floor, and found that she could not move her legs. It was a few days later that the mother noticed that she could not lift her right arm to her mouth. Friction and other measures were used, but finally she was brought to the children's dispensary. *Age when first seen*, two years. *Condition when first seen*, The arm has almost entirely recovered, but the feet are still paralysed. The muscles of the front of the legs respond but very feebly to faradisation, but better to the continuous current, after it has passed for a minute. After passing a continuous current for a minute or two they respond better to the induced, and also by Remak's mode, placing one pole on the nerve and the other on the muscle. By this mode, by 8 cells of Stöhrer's continuous current battery, pretty good contractions are obtained by placing one pole on the nerve on the inner side of the outer hamstring, and the other on the muscle and changing the poles. *Result*, much improvement.

Case 50—*Name*, John Leonard. *Age at attack*, three years, four months. *Previous history*, Was a healthy child and remained so till the present attack. Never had any fits. *Month of attack*, July. *History of attack*, About five months ago he was attacked by diarrhoea and was ill for about six weeks, and when he recovered, his mother found that he could neither walk nor stand. Soon after it was noticed that he could not hold objects in his right hand. *Age when first seen*, three years nine months. *Condition when first seen*, Varus and paralysis of right leg, paralysis of right arm involving Deltoid and Spinati muscles. Sensibility decidedly exalted. *Result*, unknown.

Case 51—*Name*, Timothy Butler. *Age at attack*, two years, six months. *Previous history*, Parents healthy. Mother has had one other child, which died from bronchitis, age four months. Patient was quite healthy till summer of 1874. *Month of attack*, June. *History of attack*, In month of June he was suddenly seized with a feverish attack. They had just moved into a newly-built house, and the plaster was not dry. He was kept in bed for four or five days, and when taken up his mother put him on his feet, and he fell down. On examination she found that he could not use his legs. No affection of arms was noticed. Since then the left leg has entirely recovered. *Age when first seen*,

four years. *Condition when first seen*, Definitive paralysis of right leg. Circumference of calf (right) six four-fifth inches ; left $7\frac{1}{2}$ inches. Right leg is $\frac{1}{4}$ inch shorter than the left. Paralysis of anterior and external muscles of leg, none of thigh. No response to either current. *Result*, unknown.

Case 52—*Name*, Mary Wilson. *Age at attack*, two years, three months. *Previous history*, Is one of six children, one of whom died from convulsions at eight months, another from heart disease (rheumatism?) at twelve years, the rest are quite healthy. The child was quite strong and healthy till two years old, when she had Scarlatina severely with abscesses in glands, and was ill for about ten weeks. Afterwards she seemed to have recovered. *Month of attack*, March. *History of attack*, One fine cold day, mother allowed her to run out of the door and missed her for about ten minutes, when she came back crying and immediately fell down. Mother went to raise her, but she screamed violently when moved. She was put to bed and continued in this state for about three weeks, when she began to improve, and finally could stand by a chair. *Age when first seen*, two years six months. *Condition when first seen*, There is definitive paralysis of the right foot and leg, which is colder than the left. Atrophy of muscles of right leg. Re-action to induced current is pretty good ; sensibility unimpaired. *Result*, unknown.

Case 53—*Name*, Alice Peckham. *Age at attack*, one year, six months. *Previous history*, Child was apparently quite healthy, and nothing wrong was noticed till it began to walk. It never had any fits or any kind of illness. *Month of attack*, April. *History of attack*, It was noticed that whilst walking both its legs dragged, and that it turned the feet in. The right leg has since recovered considerably. *Age when first seen*, one year, eight months. *Condition when first seen*, Paralysis of left leg and slightly of right. Atrophy of anterior and external group of muscles in left leg. Reduction of temperature. Stocking marks on skin. *Result*, unknown.

Case 54—*Name* William Preston. *Age at attack*, ten months. *Previous history*, Is an eight months child. Mother had diarrhoea severely, and attributes his premature birth to that fact. The preceding birth was a fine strong boy, and the succeeding one was triplets, which, however, all died the same day. Mother's

milk failed and the child had to be fed. He was always delicate and had relaxed bowels. *Month of attack*, August. *History of attack*, The boy was ten months old, when in the month of August the father, a Soldier, was sent to the Autumn Manœuvres. The mother was at Aldershot, and was putting the boy to bed when she noticed that he was hot and feverish and she went for a Surgeon; but the Regimental Surgeon was away with the Troops and she could not get a civilian Surgeon. Next day the boy was insensible, and continued very ill for some two or three days, but gradually recovered before the return of the Regiment; but when he was put to his feet he could not walk. *Age when first seen*, two years. *Condition when first seen*, Paralysis of left leg. No reaction to either current. Circumference of left calf $6\frac{1}{2}$ inches; of right calf $7\frac{1}{4}$ inches, shortening of $\frac{1}{2}$ inch. *Result*, unknown.

Case 55—*Name*, Sarah Byrom. *Age at attack*, one year, four months. *Previous history*, One of five, all healthy, parents healthy. Had no illness till sixteen months old, when she had an attack of measles followed by bronchitis which kept her off her feet for some weeks. *Month of attack*, January. *History of attack*, When she recovered from her illness, it was found that she had lost the use of both legs. The right soon recovered, but the left still remains paralyzed. *Age when first seen*, one year six months. *Condition when first seen*, Paralysis of Anterior and External muscles of left leg, but they respond to faradisation. *Result*, improvement.

Case 56—*Name*, Elizabeth Bradshaw. *Age at attack*, two years. *Previous history*, Imperfect. Mother is an unintelligent woman, and contradicts herself. The child is of a family of four, two of whom died within a month from birth. Never had fits. *History of attack*, When two years old, mother found that the child could not walk, but can give no clear account. *Age when first seen*, three years. *Condition when first seen*, Child is thin and spare, but apparently healthy. Paralysis of left leg and thigh. Muscles respond to continuous current, but only those of thigh to faradisation. Temperature lowered. *Result*, unknown.

Case 57—*Name*, Annie Holt. *Previous history*, Child was healthy and nothing was noticed till it was put to walk, when it was found that it could not

move its legs. Never had fits or any illness. *Age when first seen*, one year four months. *Condition when first seen*, Paralysis of both legs, but all the muscles respond to faradisation. No Atrophy as yet. *Result*, great improvement.

Case 58—Name, Frank Nolan. *Age at attack*, two years. *Previous history*, Was a healthy child until six months before I saw him, when he had a severe attack of diarrhoea and a number of convulsions. *Month of attack*, July. *History of attack*, Before then he could walk very well, but on his recovery he could not stand, and his head was all on one side. The mother has been very indulgent, and allowed him to have unsuitable food. *Age when first seen*, two years, six months. *Condition when first seen*, Paralysis of both legs and thighs. The reaction to faradisation is lost, but is pretty well marked with twelve cells of Stöhrer's continuous current battery. The bones are rickety, and enlarged at joints.

Case 59—Name, Ellen Kelsall. *Previous history*, Is a very strong healthy looking child. Parents farmers, and very strong and healthy. Is youngest of a family of ten. One died from a scald, and another from convulsions. This child never had fits, diarrhoea, or any other childish ailment. *History of attack*, It was not till it was put to walk that anything wrong was noticed, but then it was seen that he dragged the left leg. *Age when first seen*, one year, six months. *Condition when first seen*, Paralysis of Extensor Communis Digitorum, and Peroneus Tertius of left leg with atrophy of muscles. Response to faradisation but feeble. *Result*, still under treatment.

Case 60—Name, Richard Dempsey. *Age at attack*, eight months. *Previous history*, Is the only child of a Private of the 20th Regiment. Mother has had one other child, which died at fourteen months old from bronchitis. This one had erysipelas at six months, and was ill a fortnight. Never had any other illness until last July. *Month of attack*, July. *History of attack*, When the mother was washing at the Wash-house of the Regiment, the child was left in charge of a little girl of thirteen for the whole day. He was put to bed apparently quite well, and in the morning nothing wrong was observed, and he was put to play on the floor. At eleven a.m. she put him into bed, and he slept

about an hour, when she took him up, and saw that his left leg was useless. *Age when first seen*, one year, four months. *Condition when first seen*, Paralysis of left leg and thigh. Electro muscular contractility impaired in all muscles of leg and of anterior and inner part of thigh. Sensibility unimpaired. *Result*, under treatment.

Case 61—Name, Hector Horne. *Age at attack*, nine months. *Previous history*, The first child of healthy robust parents, and was quite well and could walk by chairs before his present illness. *Month of attack*, September. *History of attack*, They took him out on a very cold and windy day, and when he was brought home he began to cough, and shortly afterwards was seized with convulsions which lasted till next morning. A day or two after she put him to his feet and found that he could not use his legs. They recovered very considerably soon after, and continued to improve for a fortnight, but the right leg is still paralysed. *Age when first seen*, one year, 2 months. *Condition when first seen*, Paralysis of right leg. Electro muscular contractility entirely abolished to faradaic current, but slight reaction to 12 cells of Stöhrer's continuous current battery. *Result*, under treatment.

Case 62—Sarah Eyre. *Age at attack*, eleven months. *Previous history*, Child was quite healthy and walked from chair to chair. Never had fits or any other illness till the present one. *Month of attack*, July. *History of attack*, One very hot day in July the door was open all day, and the child was playing on the flag floor all day long. About 7 p.m. mother put her to bed, and noticed that she seemed hot and feverish. She fell asleep at once, but had not been so long when she woke screaming, and her mother took her up and walked about with her for a quarter of an hour, when she fell asleep again, and for three or four days the child seemed tired, ill and sleepy, and did not want to get up. At the end of this time her mother took her out of the cradle and dressed her, and found that the right leg hung helpless. She put her down to see whether she could walk, but found that she could not. She improved slightly, but no skilled advice was obtained for her for more than two years. *Age when first seen*, three years. *Condition when first seen*, Right leg measures round calf $6\frac{1}{4}$ inches; left $8\frac{1}{4}$ inches. Right thigh measures, $10\frac{1}{2}$ inches; left $11\frac{1}{2}$ inches. Para-

lysis of Quadriceps Extensor, but it reacts to continuous current when it is interrupted at frequent intervals. No reaction to induced current is perceptible in any of the paralysed muscles. *Result*, no improvement.

Case 63—*Name*, Leah Jones. *Age at attack*, one year, ten months. *Previous history*, Youngest of four children, all healthy. Never had any illness till ten or twelve weeks ago. Could run about and walk well. Had vulvitis and intertrigo, and was at school "to keep her out of mischief," mother says. *Month of attack*, June. *History of attack*, Keeping her at home on account of the vulvitis, mother noticed that she was hot and feverish, and she fell on her face cutting her lip. Nothing further was noticed for a week or two, when one Tuesday, the child having walked the previous day, it was found that she could not use her right leg, and the following day the arm was found to be powerless. From that time the arm has somewhat recovered, but the leg remains in much the same condition. *Age when first seen*, two years. *Condition when first seen*, Paralysis of deltoid, and of anterior muscles of right leg also of rectus femoris, of extensor of fingers, and of most muscles coming from outer condyle of humerus. All respond to faradisation. *Result*, still under treatment.

